FEBRUARY 1951

ELECTRICAL CONSTRUCTION AND MAINTENANCE

WITH ELECTRICAL CONTRACTING

JOB POSTING speeds customer service at Sturgeon Electric Co. in Denver.

BATTERY MAINTENANCE depends upon proper use and care of the hydrometer and thermometer.

ASSEMBLY LINE methods, efficient tooling on a mass housing project.

SPACE TO SPREAD our plans for estimating material is provided on this two-sided bench design.

A McGRAW-HILL PUBLICATION | 50TH YEAR

New "MIDGET SUBSTATION" makes lamps burn brighter, last longer

G-E INDUCTROL POWER PACK

combines breaker, transformer, regulator in one convenient package

If your plant has combined light and power circuits, you may have noticed how illumination can fall off during plant load peaks. You may also have had trouble with shortened lamp life due to overvoltage.

In either case, here's a brand new "packaged" answer to better voltage regulation—the G-E Inductrol Power Pack.

The new Inductrol unit is, in effect, a midget load-center substation, combining circuit breaker, transformer, and induction voltage regulator in one convenient, space-saving package. It takes the 480 or 600 volts from your power line and converts it to the uniform 120 volts required for maximum lamp output and life. For greater production, more accurate testing, and better performance of electronic equipment, investigate the new G-E Inductrol Power Pack. Contact your G-E sales representative, or authorized G-E agent—or mail your coupon today. *Apparatus Dept., General Electric Co., Schenectady 5, N. Y.*

G-E Inductrol Power Packs on factory's roof stanchions are housed in attractive, completely metal-enclosed, easily installed cabinets.

INDUCTROL POWER PACK

General Electric Co., Section B 321-73
Apparatus Department
Schenectady 5, N. Y.

Please send me Bulletin GEA-3571 on the new G-E Inductrol Power Pack.

Bulletin needed for:

..... Reference purposes

..... Planning an immediate project

NAME .....

POSITION .....

ADDRESS .....

CITY ..... ZONE ..... STATE .....

GENERAL ELECTRIC

Murray the Circuit Breaker that has a special advantage

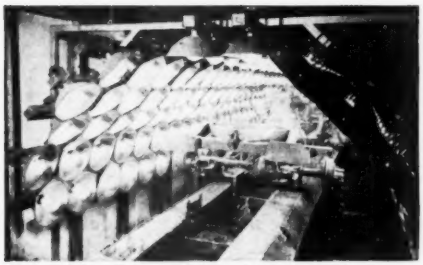
Fully Magnetic!

Where it's HOT

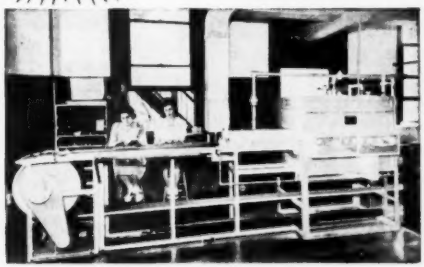
IT CARRIES FULL LOAD REGARDLESS OF TEMPERATURE

Circuit protection is provided entirely by magnetic action. Because Murray Circuit Breakers are fully magnetic, they trip only on short-circuits and dangerous overloads. They always carry the full load, regardless of temperature. They never need "derating."

Where it's HOT



An Infra-Red Baking Tunnel



An Electric Brazing Furnace

Murray Circuit Breakers are ideal under *all* conditions and especially *where it's hot*. In every plant and power company there are places where a Murray Magnetic Circuit Breaker is a *must*: boiler rooms, furnace rooms and near Infra-Red Banks, Induction Heating Coils, Annealing Furnaces, Soldering Pots, Baking Ovens and Tunnels, Radiant Heaters, Convection Heaters, Drying Chambers, Brazing Furnaces. If you have these, or any similar conditions, make sure your protective equipment will carry full load at all times—Use Murray Fully Magnetic Circuit Breakers.

IF YOU WANT TO INSTALL THE BEST... specify Murray

Murray®

MURRAY MANUFACTURING CORPORATION
1250 ATLANTIC AVENUE • BROOKLYN 16, NEW YORK

Service Entrance & Meter Equipment • Magnetic Circuit Breakers • Switches
Current Limiting Reactors • Crows'nest Aerial Ladders

Type EFU—First and still finest Explosion-Proof Fluorescent Lighting Fixture. Available for two 40 Watt, 48" lamps or two 100 Watt, 60" lamps. Pat. No. 2,393,202

Industrialite High Mounting Fixture—For railroad yards, steel mills, roundhouses—any industrial plant calling for a rugged, built, high-mounted lighting fixture.

BETTER LIGHT *for* BIGGER PRODUCTION

RLM Standard Dome Fixture—Reflector made of rust-resisting iron and finished with three coats of baked porcelain enamel. Sectionalized construction permits easy installation and convenient servicing.

Stocklite—Provides perfect illumination for shelves and bins in stock rooms.

Fewer rejections . . . greater safety . . . better employee relations . . . increased efficiency to meet defense demands—these are the immediate returns on an investment in good industrial lighting.

Appleton Industrial Lighting Equipment is precision-designed to provide *good light*—the right light, without uncomfortable glare, troublesome contrast or shadow. Expert engineering, unequalled manufacturing facilities and nearly a half century of experience are combined in each Appleton fixture to provide maximum efficiency at minimum installation, service and operating expense.

Appleton Lighting Fixtures are made to suit every industrial requirement—including hazardous locations—whether indoors or out. For the finest illuminating equipment or expert assistance on any lighting problem, contact Appleton—Standard for Better Lighting.

APPLETON LIGHTING EQUIPMENT

Sold Through Electrical Wholesalers

APPLETON ELECTRIC COMPANY

1704 WELLINGTON AVENUE • CHICAGO 13, ILLINOIS

Branch Offices: NEW YORK, 50 Church St. • DETROIT, 3049 E. Grand Blvd. • CLEVELAND, 1836 Euclid Avenue • SAN FRANCISCO, 655 Minna St. • ST. LOUIS, 227 Frisco Bldg. • LOS ANGELES, 100 N. Santa Fe Avenue • ATLANTA, 724 Boulevard, N.E. • BIRMINGHAM, 429 Brown-Marx Bldg. • MINNEAPOLIS, 305 Fifth St., S. PITTSBURGH, 414 Bessemer Bldg. • BALTIMORE, 100 East Pleasant, St. • BOSTON, 10 High Street • DENVER, 1921 Blake Street • PHILADELPHIA, 1017 Cherry Street CINCINNATI, 626 Broadway • HOUSTON, 709 M. & M. Bldg. • HAVANA, Cuba, Malecon No. 9.

Resident Representatives: Binghamton, Dallas, Indianapolis, Kansas City, Orlando, Milwaukee, New Orleans, Seattle, Portland, Ore.

Export Representatives: International Standard Electric Corp., 67 Broad St., New York 4, N. Y.

A P P L E T O N

CONDUIT FITTINGS • LIGHTING EQUIPMENT • OUTLET AND SWITCH BOXES • EXPLOSION-PROOF FITTINGS • REELITE

ELECTRICAL CONSTRUCTION AND MAINTENANCE

With which is consolidated Electrical Contracting, The Electrical and Electrical Record . . . Established 1901

Published for electrical contractors, industrial electricians, engineers, consultants, inspectors and motor shops. Covering engineering, installation, repair, maintenance and management, in the field of electrical construction and maintenance.

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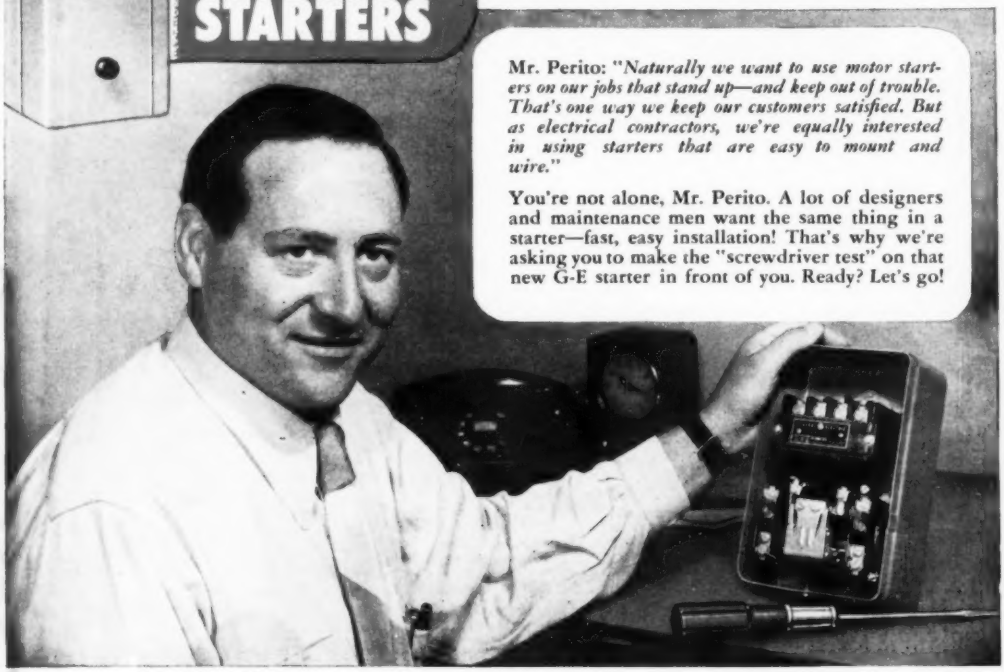
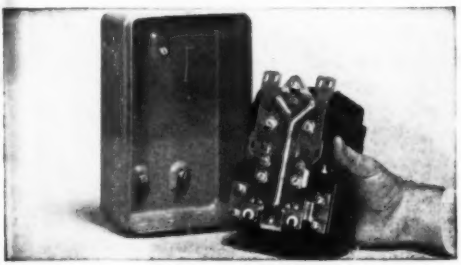
MOTOR STARTERS ...easier to

T.G. PERITO, ELECTRICAL CONTRACTOR, LEARNS



Mr. Perito: "*Naturally we want to use motor starters on our jobs that stand up—and keep out of trouble. That's one way we keep our customers satisfied. But as electrical contractors, we're equally interested in using starters that are easy to mount and wire.*"

You're not alone, Mr. Perito. A lot of designers and maintenance men want the same thing in a starter—fast, easy installation! That's why we're asking you to make the "screwdriver test" on that new G-E starter in front of you. Ready? Let's go!



1 Mr. Perito: "*How is this contactor mounted in the case?*"
By means of keyhole slots you see in the contactor base, Mr. Perito. After you've mounted the empty case on the wall or a machine, you locate the keyhole slots over the mounting screws and the contactor slips into place!

2 Mr. Perito: "*Lots of knockouts, I see!*"
You'll find these on every side of the case—more than enough to give you faster, neater installations. Plenty of room on the inside, too, and notice how the light grey finish on the inside gives you plenty of reflected light!

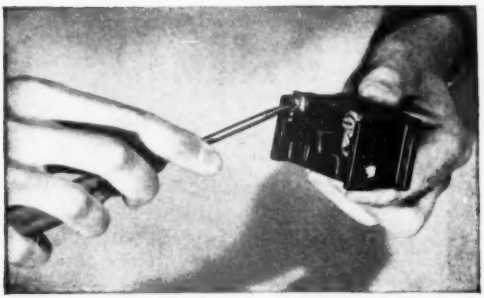
GENERAL ELECTRIC

730-18

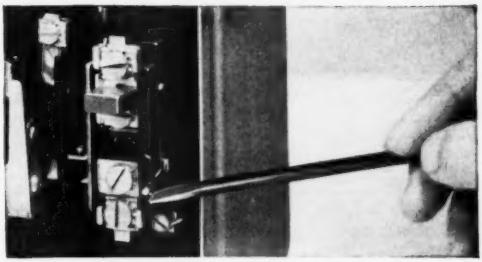
install for these 6 reasons

ABOUT THESE IMPORTANT FEATURES WITH THE "SCREWDRIVER TEST"

3 Mr. Perito: "*Are all the terminals easy to get at?*" Every one of them is *up front* where it's easy to get at, and wire. And they're *big* terminals with panhead screws and saddle-type connectors that ride up with the screw head. The stripped wire simply slides into place and is easily secured with a turn of your screwdriver.



4 Mr. Perito: "*Tough-looking coil! Is it new?*" Right! It's called the "Strongbox Magnet Coil" and it's an exclusive with the new G-E starter line. Feel how solid it is! If your electrician's screwdriver slips, it can't hurt the windings—they're safely locked in a block of molded plastic. And oil, dust or water can't get at them, either!



5 Mr. Perito: "*How do I set the overloads?*" Easy—and you don't have to take the starter apart to do it. Flip that little lever and it's on "Automatic." Flip it back and it's on "Manual." Heaters are in the front, can be changed without disturbing any wiring.

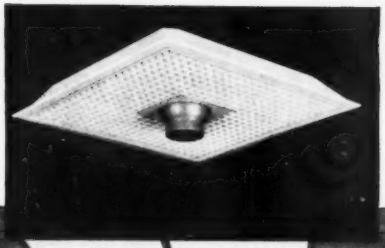
6 Mr. Perito: "*What about maintenance?*" Once this new G-E starter is installed, it *stays* installed. There's no need to remove the case for ordinary maintenance or even to replace or reverse contacts. Just remove the arc chute and there are your terminals.

WHY DON'T *YOU*

"BUY ONE AND COMPARE?"

See for yourself why this new line of G-E motor starters lasts longer, costs less to install than almost any other starter you can buy. Your G-E representative or authorized G-E agent or distributor can supply you from stock in NEMA sizes 0, 1, 2 and 3 for a-c motors up to 50 hp. For a complete description, write for Bulletin GEA-5153. *Section 730-18, Apparatus Dept., General Electric Company, Schenectady 5, New York.*

EASY ON THE EYES
and easy on the budget!



Skylike—the new kind of lighting that looks like fluorescent but has silvered-bowl incandescent features—has basic advantages that make its installation and maintenance more economical than for most lighting equipment.

Skylike units reduce job time because they are lightweight. They weigh only 15 pounds—are 50% or more lighter than other recessed lighting units . . . require less support.

Skylike units are simple in construction and internal wiring. Because there are no starters, ballasts, or transformers to get out of order, service call-backs are virtually eliminated.

Maintenance men, too, like the ease with which a Skylike unit can be relamped . . . the way its easily accessible baked enamel reflector wipes clean with only a damp cloth.

Try Skylike units on your next lighting installation—it's the only lighting system that offers *all* the advantages listed below.

1. High initial and maintained light output—Built-in ceiling reflector provides 87% reflection . . . eliminates loss of light due to darkening walls and ceilings. Baked enamel finish does not discolor. Silver reflecting surface of lamp is hermetically sealed against dirt and corrosion.

2. Ideal light characteristics—Skylike lighting provides softly diffused shadows, comfortable low-brightness levels, and the warm color preferred by merchandising experts.

3. Easily converted for directional or accent lighting. A semi-silvered-bowl lamp and a simple accessory replace the original lamp.

4. No flicker, no blink, no hum—Skylike units operate without starters, ballasts, or transformers . . . start the instant the switch is thrown.

5. Low installation cost—Lightweight Skylike units require only minimum supporting construction, require no special installation skills.

6. Variable lumen output—150- to 500-watt lamps are interchangeable in Skylike units—provide lighting flexibility of 2,500-10,000 lumens.

7. Low initial investment—Skylike lighting costs only ½ to ⅓ as much as other equipment delivering comparable results.

8. Wide architectural latitude—Skylike units fit 24" x 24" ceiling tiles . . . can be fully or partially recessed or surface-mounted—in rows or patterns.

SILVRAY

Skylike*

*Patent pending

Graybar Distributed by Graybar Electric Company

Send coupon for Skylike booklet

Graybar Electric Company, Inc.
Graybar Building
420 Lexington Avenue
New York 17, New York

Please send me a copy of "Skylike Louvered Incandescent Lighting Systems."

Name _____ Title _____

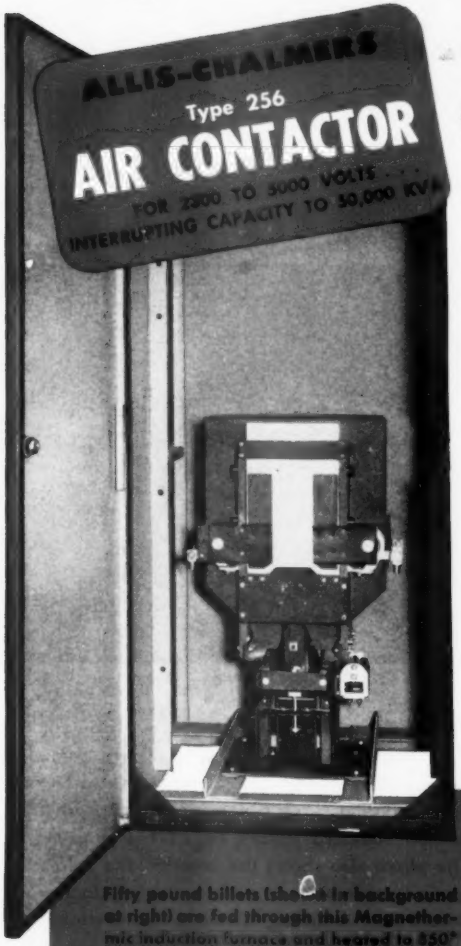
Firm _____

Address _____

City _____ Zone _____ State _____

5112

30,000 Operations *EVERY* Month



Fifty pound billets (shown in background at right) are fed through this Magnethermic induction furnace and heated to 850° at the rate of one per minute. The contactor must open as each billet is unloaded from the furnace and fed into the extrusion press at left . . . adds up to about 30,000 operations at full load each month.

A-3229

"THIS TYPE 256 CONTACTOR operates under full load approximately 30,000 times per month. We have yet to find another contactor that will stand up under this service!" says J. A. Logan, president of Magnethermic Corporation, manufacturers of low frequency induction heating equipment.

"This contactor is now standard equipment on all of our 2300 and 4000 volt furnaces. All other high voltage contactors that we originally installed on our furnaces have been replaced by the Allis-Chalmers Type 256 Air Contactor."

Opening and closing the primary of an induction furnace at full load once every minute may be different than your control problem. But think of the years of trouble-free service a contactor capable of this duty will give you on normal motor starting applications!

What makes performance like this possible? Double break contacts and straight line vertical action are combined in Type 256 Air Contactors to eliminate maintenance factors such as flexible contact leads, turning shafts and shaft bearings.

Magnethermic Corporation's experience is typical . . . indicates the service you too can expect from Type 256 Air Contactors. These contactors are clean, easy to inspect, accessible, and compact. Call your Allis-Chalmers representative, or write for bulletin 14B7303. Allis-Chalmers Mfg. Co., Milwaukee 1, Wisconsin.

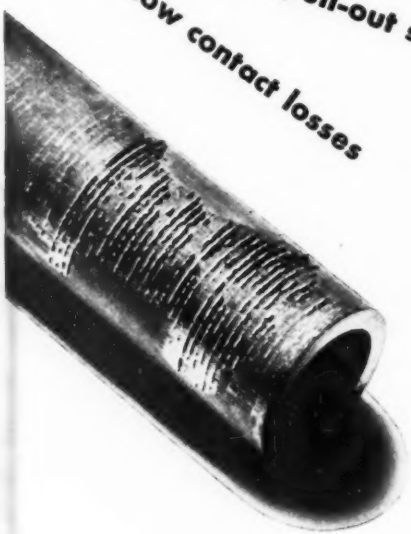
ALLIS-CHALMERS

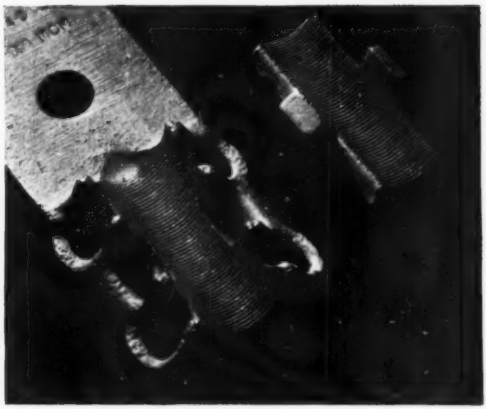
GENERAL ELECTRIC POWER CONNECTORS HAVE

MACHINE-SERRATED CONTACT SURFACES

for high pull-out strength

for low contact losses





Here's the way the machine-serrated contact surfaces on G-E power connectors bite into the conductor (500 MCM tubing shown). For this test a hand wrench was used to tighten the connector (right). Tension was then applied. Above photo shows that the copper "backed up." This action assures a high-conductivity joint that will resist vibration and give positive pressure on the conductor at all times.

Disassembled G-E power connector showing the sharp serrations machined (not merely cast) into the contact surfaces—an exclusive General Electric feature. Note that all contact surfaces are silvered, another standard feature on all G-E connectors. The photo also shows the interlocking sides that confine cable strands within the conductor enclosure thus obtaining full advantage of the cable's current-carrying capacity.

Place an order today with your G-E sales representative and start realizing the many benefits to be gained by using General Electric connectors. Also, write for a copy of bulletin GEC-400 that contains 40 pages of valuable information on G-E connectors and see for yourself how easy they are to order. Write to *Apparatus Department, Section 856-54, General Electric Company, Schenectady 5, New York.*

GENERAL ELECTRIC

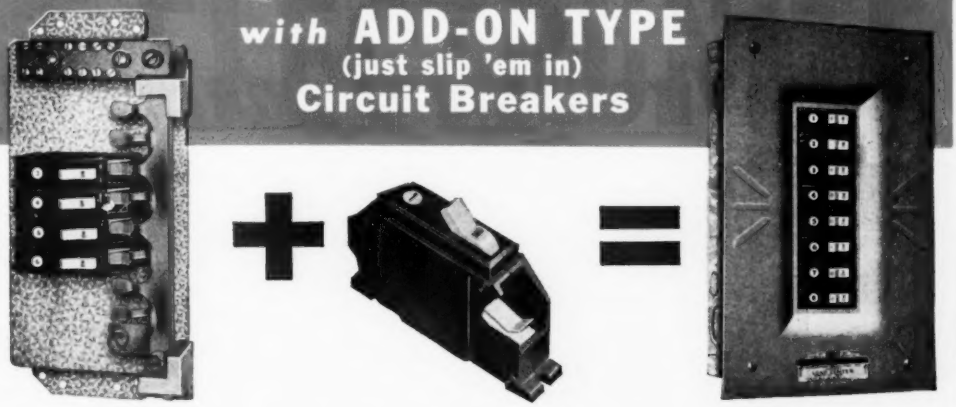
856-54

Reduce Inventory, Increase Sales and Profits

with the new

LOAD CENTERS and SERVICE EQUIPMENT

with **ADD-ON TYPE**
(just slip 'em in)
Circuit Breakers



ALL THE FEATURES of dependable thermal-magnetic automatic circuit protection . . . plus . . . the *add*-ed convenience and flexibility of ADD-ON TYPE CIRCUIT BREAKERS are now incorporated into (FA) Load Centers and Service Equipment.

Five basic units (see chart) plus a stock of individually-packaged single pole and double pole (FA) THERMAG type circuit breakers meet any job requirement . . . from then on it's a simple matter of addition to add new circuits . . . change capacities . . . or replace damaged units. Because all ADD-ON breakers are interchangeable and readily installed, it's as easy as buying and replacing light bulbs. Other features are the screwless assembly and only one pressure type connection between circuit breaker and bus bar.

This flexible system of load center assemblies made-up with *individual circuit breakers* was pioneered by (FA) almost 20 years ago. Today, with the plus value of the ADD-ON breaker, wholesalers can carry a reduced stock (instead of an assortment of combinations) yet meet any job requirement "off the shelf." It's sure to increase sales and avoid errors because any order can be filled from stock with individually-packaged ADD-ON breakers.

For everyone concerned, it all adds up to greater convenience, flexibility and economy. So write for your copy of Bulletin No. 204 which describes the new ADD-ON feature of (FA) Load Centers and Service Equipment.

Type	Cat. No.	Basic Unit	Max. Feeder Capacity	Maximum Total Poles*
THERMAG	(FA)LC4-4F (or S)	4-S.P., 2-S.P. and 1-D.P., or 2-D.P. (specify requirements)	100 Amp.	8
THERMAG	(FA)LC4-8F		100 Amp.	12
THERMAG	(FA)LC4-12F		100 Amp.	16
THERMAG	(FA)DLC4-8		100 Amp.	12
THERMAG	(FA)DLC4-16		100 Amp.	20

*Including any number of Double Pole.

Complete factory assemblies also furnished on special order. Similar units with QUICKLAG Circuit Breakers also available! Add "Q" to catalog number: thus (FA) "QLC4-4," etc.

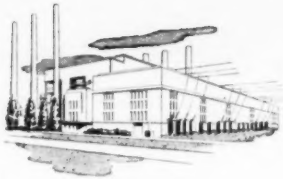
Other add-on units with 30 amp. maximum capacity (FA) JUNIOR Type Thermal trip circuit breakers (6 poles or less, including 1 D.P.) are available.

Frank Adam Electric Co.

ST. LOUIS 13, MISSOURI

Makers of BUSDUCT • PANELBOARDS • SWITCHBOARDS • SERVICE EQUIPMENT • SAFETY SWITCHES • LOAD CENTERS • QUIKMETER

Our 60th Year



Pacific Gas and Electric's New Contra Costa Steam Plant

Wired *the Modern Way*

with ELECTRUNITE E.M.T. Raceways

Electricity is the business of the Pacific Gas and Electric Company. And you can be sure that any electrical product used in their own plants meets their rigid requirements for safety, dependability and sound installation practice.

ELECTRUNITE E.M.T.—the *modern*, lightweight, rigid steel raceway—does all of that, *and more*. ELECTRUNITE E.M.T. saves trouble and time on installations, too.

Stubs, bends, offsets can be formed easily and accurately—on the job or prefabricated. And installations in hard-to-get-at places are easy with ELECTRUNITE E.M.T. No turning of tubing is needed. Modern compression fittings set up strong, concrete-tight joints. Wire pulling is easier, too. The knurled inside surface of ELECTRUNITE E.M.T. (in most-used sizes) reduces drag as much as 30%!

ELECTRUNITE E. M. T. is approved for exposed, concealed and concrete slab installations by the National Electrical Code, and meets the requirements of Underwriters' Laboratories.

CHECK WITH YOUR ELECTRUNITE DISTRIBUTOR

Give him as much time as possible to plan ahead on your requirements. And even though he may be unable to supply all of your raceway needs, you can be sure that he will do everything possible to help solve your material supply problems.

REPUBLIC STEEL CORPORATION
STEEL AND TUBES DIVISION • CLEVELAND 8, OHIO
Export Department: Chrysler Building, New York 17, N. Y.

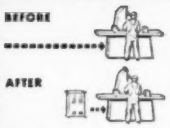
REPUBLIC STEEL

Republic ELECTRUNITE E.M.T.

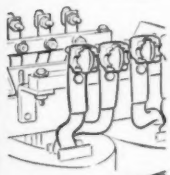
LIGHTWEIGHT THREADLESS RIGID STEEL RACEWAY

Cut Waste Power!

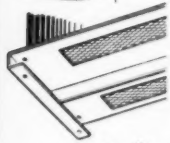
ALLIS-CHALMERS Dry-Type Transformers



ELIMINATE long runs of secondary copper . . . save through reduced power consumption, improved machine and lighting efficiency, increased system flexibility, lower cable installation costs.



TIME-SAVING solderless connectors are standard on units 15 through 50 kva, single phase, and 37½ through 100 kva, three phase. On larger sizes, flat drilled bars are arranged vertically for any connector.



RAPID THRU-DRAFT ventilation is obtained by air inlet through base and outlet through cover overhang. Natural chimney draft action draws air through vertical air ducts in coils. Class B insulation used throughout.

BUILT for hard service. Sturdy side frames retain alignment and rigidity of core and coil structure. Case is all-welded, *Spra-Bonderized,* receives 3 coats of baked-on resilient paint.

LOOKING FOR WAYS to cut production costs? Here's a tip — check for below-normal voltages at lamps, motors and heating loads.

Did you know that a 10% correction in voltage will recover a 30% illumination loss? . . . 20% motor starting torque loss? . . . 19% output loss in heating operations?

To side-step these losses and get the most out of your power bill, install Allis-Chalmers "dry-types" right at loads. You'll 1) improve voltage regulation for better lamp, motor, and thermal efficiency; 2) make added savings through reduced line losses.

And they're easy to mount. Put them on overhead platforms, machines, posts or walls. No firewall needed.

Transformers are stocked country-wide in popular ratings. For information and bulletin 61B6382A contact your A-C Dealer or A-C Sales Office.

A-3025

ALLIS-CHALMERS, 930A SO. 70 ST. MILWAUKEE, WIS.

ALLIS-CHALMERS

CRESCENT

SYNTHOL BUILDING WIRES

TYPE TW
For Both Wet and Dry Locations

FOR BETTER WIRING

For Lower Costs—
Easier Handling

USE THIS ONE TYPE FOR ALL YOUR BRANCH CIRCUIT REQUIREMENTS

CRESCENT SYNTHOL—Type TW, Building Wires and Cables are insulated with a special, tough, thermoplastic compound that results in wires of unexcelled Permanence, Safety, Adaptability and value. They combine high dielectric and mechanical strength with the following desirable features.

SMALL DIAMETER—has smallest outside diameter for same conductor size, permitting more conductors, or larger conductors in same space.

FLAME RETARDING—SYNTHOL insulation will not support combustion.

LONG LIFE—practically unaffected by continuous exposure for years to sunlight or air; more stable than any rubber insulation.

RESISTANT to moisture, acids, alkali and most chemical solvents.

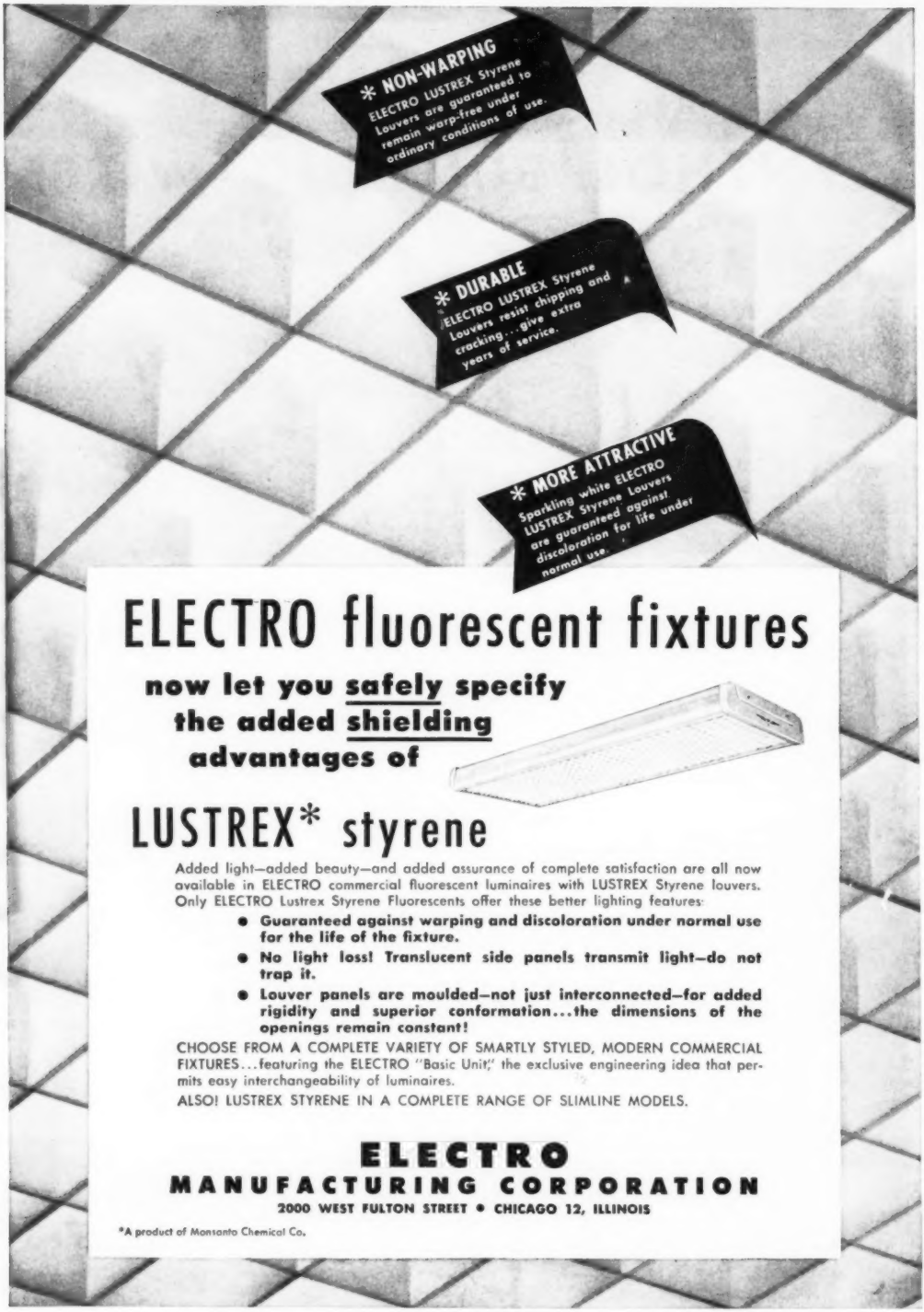
OILPROOF —cutting oils, greases and petroleum solvents do not injure SYNTHOL.

BRIGHT COLORS—non fading, the insulation is the same color throughout so color will not scrape off; easily cleaned twelve colors.

FREE STRIPPING—makes splicing and soldering easier and faster.

EASY PULLING—because SYNTHOL wires have a permanent clear wax lubrication on their hard, smooth, abrasion resistant surface.

CRESCENT
WIRE & CABLE
CRESCENT INSULATED WIRE & CABLE CO.
TRENTON, N. J.


* NON-WARPING
ELECTRO LUSTREX Styrene Louvers are guaranteed to remain warp-free under ordinary conditions of use.
* DURABLE
ELECTRO LUSTREX Styrene Louvers resist chipping and cracking...give extra years of service.
* MORE ATTRACTIVE
Sparkling white ELECTRO LUSTREX Styrene Louvers are guaranteed against discoloration for life under normal use.

ELECTRO fluorescent fixtures

now let you safely specify the added shielding advantages of

LUSTREX* styrene

Added light—added beauty—and added assurance of complete satisfaction are all now available in ELECTRO commercial fluorescent luminaires with LUSTREX Styrene louvers. Only ELECTRO Lustrex Styrene Fluorescents offer these better lighting features:

- **Guaranteed against warping and discoloration under normal use for the life of the fixture.**
- **No light loss! Translucent side panels transmit light—do not trap it.**
- **Louver panels are moulded—not just interconnected—for added rigidity and superior conformation...the dimensions of the openings remain constant!**

CHOOSE FROM A COMPLETE VARIETY OF SMARTLY STYLED, MODERN COMMERCIAL FIXTURES...featuring the ELECTRO "Basic Unit," the exclusive engineering idea that permits easy interchangeability of luminaires.

ALSO! LUSTREX STYRENE IN A COMPLETE RANGE OF SLIMLINE MODELS.

ELECTRO
MANUFACTURING CORPORATION
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*A product of Monsanto Chemical Co.

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Architect?

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Wholesaler?

Whatever your particular interest in steel switch and outlet boxes, you know the *Quality* that makes Raco products unfailingly dependable, the *Completeness* of the Raco line for all commercial and home wiring jobs. Add to these the *Approval* by Underwriters' Laboratories, Inc. and you have all the assurance you need that Raco is right. All of this is the result of policy—a disciplined resolve to make Raco products the top line in the market.

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the right cable for the job

flush 'em — you nail 'em!

Yes, Anaconda opens 1951 with a brand-new industry-wide *"Power Up—And Be Prepared"* program.

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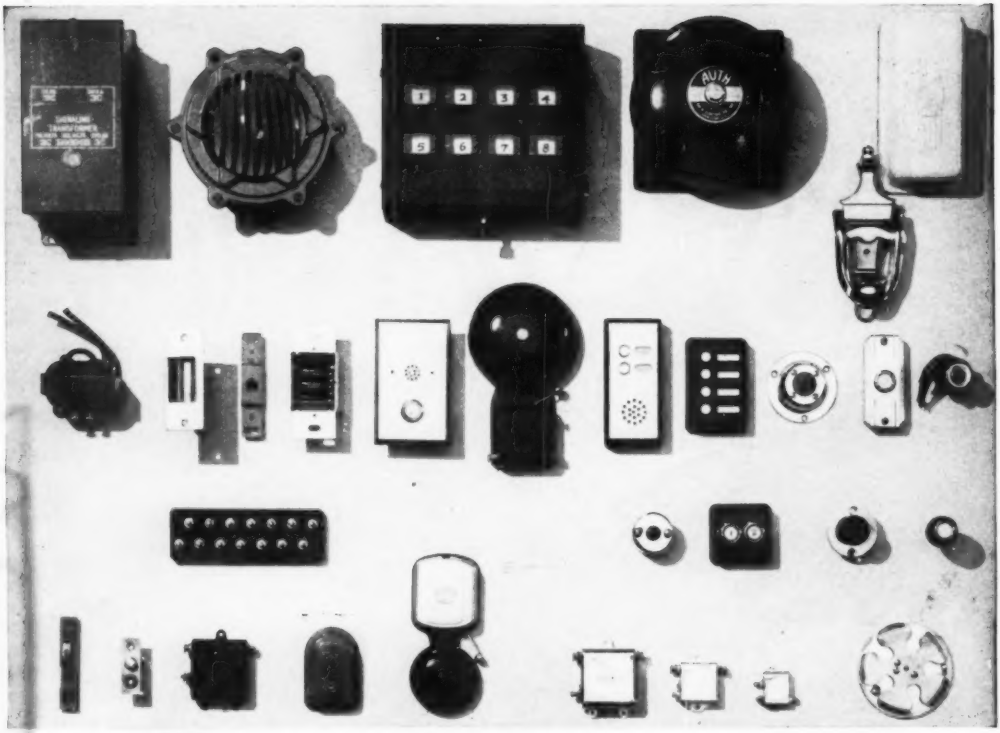

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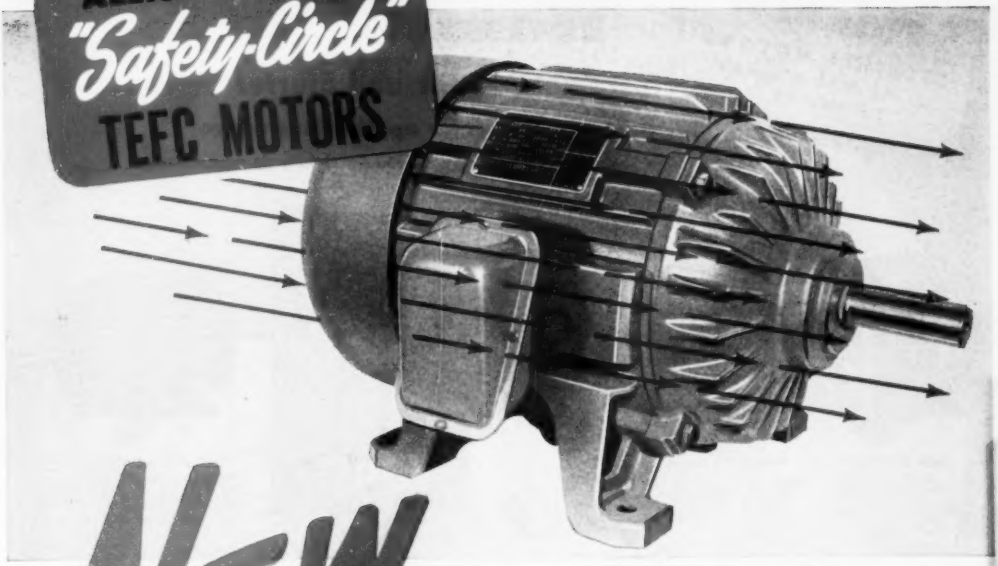
ALLIS-CHALMERS

"Safety-Circle"

TEFC MOTORS



NEW Easy to Clean Resists Corrosion

CORROSIVE ATMOSPHERES CAN'T HURT this Allis-Chalmers totally enclosed, fan-cooled motor because major parts are enclosed in a rigid corrosion resistant cast iron frame! No extra treatment is needed and cast iron's corrosion resistance won't chip off.

Lower Maintenance, Too

No corners, pockets or hidden air passages to collect dirt. Cleaning is the simplest of maintenance operations. Just blow off the dirt with an air hose. Fan and housing design keep cooling airflow tight against the yoke so dirt does not accumulate and cleaning is seldom required.

Factory Lubricated Bearings

Bearings are lubricated at the factory and operate without attention or cost for years. Extra rigidity of the cast iron frame holds bearings in true alignment under all operating conditions. This gives long bearing life and low operating costs.

Get All The Facts

The new *Safety Circle* totally-enclosed fan-cooled motor is built in all NEMA standard frame sizes from 224 to 505. Call your nearest Allis-Chalmers Authorized Dealer or Sales Office for complete information or write Allis-Chalmers, Milwaukee 1, Wisconsin. Ask for Bulletin 51B6144. A-3228

Safety Circle, *Texrope* and *Vari-Pitch* are Allis-Chalmers trademarks.

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Serviced . . .

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CONTROL — Manual, magnetic and combination starters; push button stations and components for complete control systems.

TEXROPE — Belts in all sizes and sections, standard and *Vari-Pitch* sheaves, speed changers.

PUMPS — Integral motor and coupled types from ¾ in. to 72 in. discharge and up.

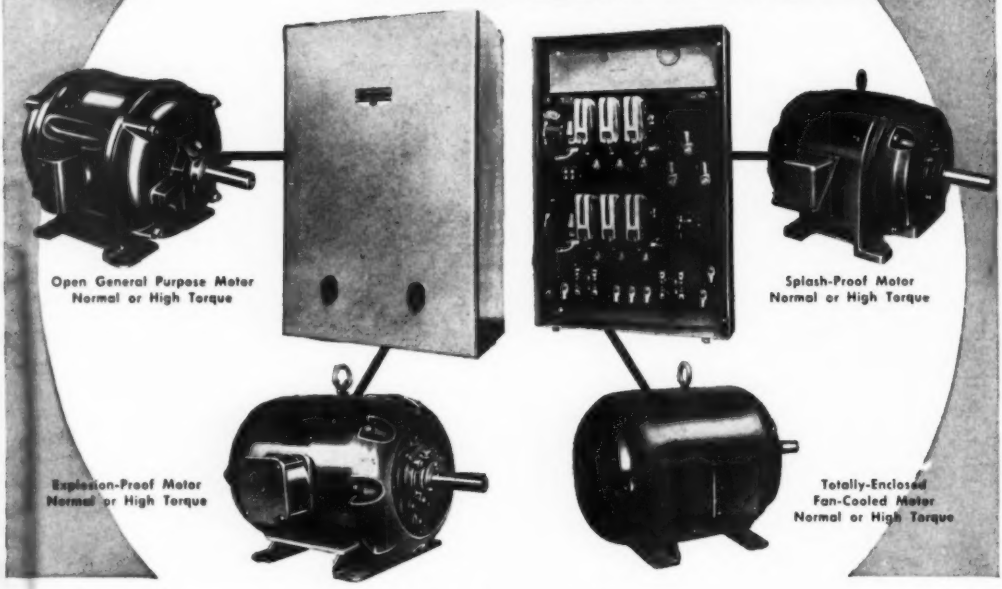
ALLIS-CHALMERS

Wagner®
ELECTRIC MOTORS
...the choice of leaders in industry

Wagner

Increment Motor and Starter Combination

...most economical for applications where reduced starting current draw is required



easy does it...

You can meet locked current restrictions by limiting the in-rush of motor current during the starting period with the low cost Wagner Increment Motor and Starter "Package". This motor and control combination is excellent for use on any application where reduced current draw at start is required.

Wagner polyphase motors, both normal and high torque, are wound with two circuits in parallel. When the increment starter is operated, its first magnetic contactor closes and puts half of the motor winding across the line, so that the motor draws only approximately 60% of its normal locked rotor current from the line. At the same time the circuit is closed to an adjustable pneumatic timer and at the completion of the timing cycle the second magnetic contactor closes, putting the second half of the winding in parallel with the first.

The Wagner Increment "Package" is economical to install, and makes possible the use of high grade magnetically operated equipment at a low purchase price.

Why not investigate this Wagner combination today? Write for full information.

Consult the nearest of Wagner's thirty-one branch offices, in all principal cities, for expert advice on your motor application problems.

Wagner Electric Corporation
1891 WE 1951

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ELECTRIC MOTORS • TRANSFORMERS • INDUSTRIAL BRAKES
AUTOMOTIVE BRAKE SYSTEMS — AIR AND HYDRAULIC

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PLANNING AERIAL CIRCUITS?...
CIRCUITS TO BE BURIED DIRECTLY IN EARTH?...
CIRCUITS TO BE INSTALLED IN DUCTS OR CONDUIT?

• Here's one cable for all three services

THAT SAVES and SAVES and SAVES!!

SAVES ON FIRST COST. Simplex-ANHYDREX Cables save you money at the outset for their moisture-resisting Anhydrex insulation and their tough neoprene jacket combine to eliminate the need for costly metallic sheaths or other protective coverings. They save you the expense of buying and stocking a variety of cables for different applications as they are designed for use — as is — in open air, in the earth, and in ducts or conduit. They are Type RR Cables. They have CAA approval as underground cables for airport lighting under Specification L-824. They are suited for use as underground service entrance cables and when requested bear Underwriters' Type USE labels. You'll find them ideal, too, for street and park lighting, as Drive-In-Theatre Cable, and in signal and control circuits.

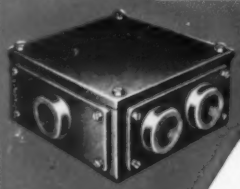
SAVES ON INSTALLATION. The comparatively light weight and small diameter of ANHYDREX Cables, their flexibility, and their smooth jacket surface result in worthwhile savings on installation. Crews work faster, more efficiently, for they find ANHYDREX Cables easy to handle, easy to splice, joint and terminate. When pulling the cable through ducts no oil or grease lubricants are needed. Marks, letters, or figures may be molded onto the jacket to provide instant identification of circuits.

SAVES ON MAINTENANCE. Simplex-ANHYREX Cables promise long, dependable service, free of untimely failures and costly maintenance. Their Anhydrex insulation has excellent dielectric properties and provides steadfast resistance to water and moisture. The neoprene jacket is resistant to abrasion, soil acids and alkalies, oil, flame, sunlight and weathering. Having no metallic coverings, the cables are not subject to electrolysis nor harmed by vibration, stray or secondary currents.

SIMPLEX-ANHYDREX

SIMPLEX WIRE & CABLE CO.
79 SIDNEY STREET
Cambridge 39, Massachusetts

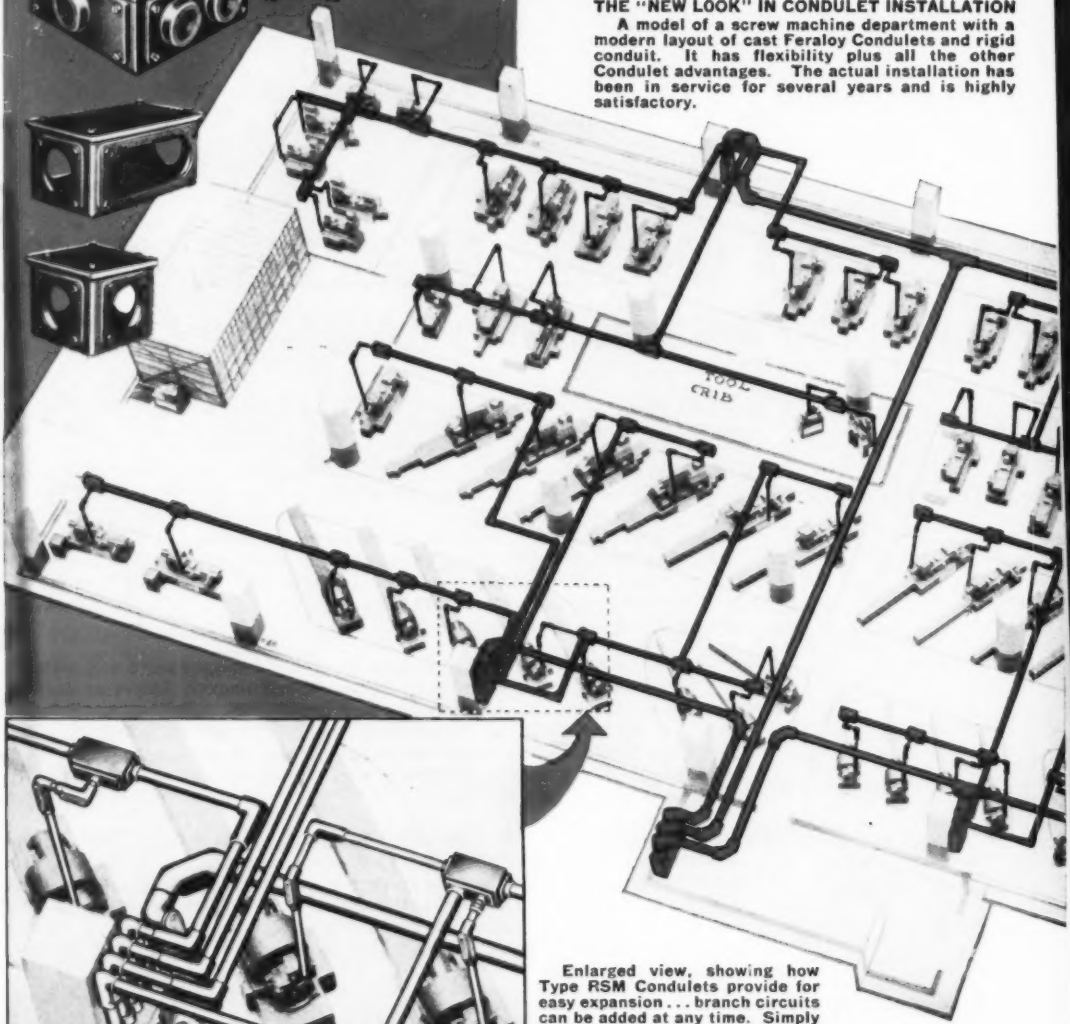
for MODERN WIRING... the conduit and CONDULET*

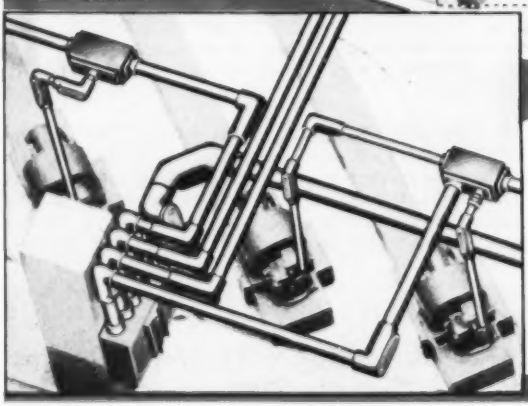


RS Series
Junction Condulets take detachable hub plates with 1, 2, or 3 hubs for conduit from ½" to 3½"

THE "NEW LOOK" IN CONDULET INSTALLATION

A model of a screw machine department with a modern layout of cast Feraloy Condulets and rigid conduit. It has flexibility plus all the other Condulet advantages. The actual installation has been in service for several years and is highly satisfactory.



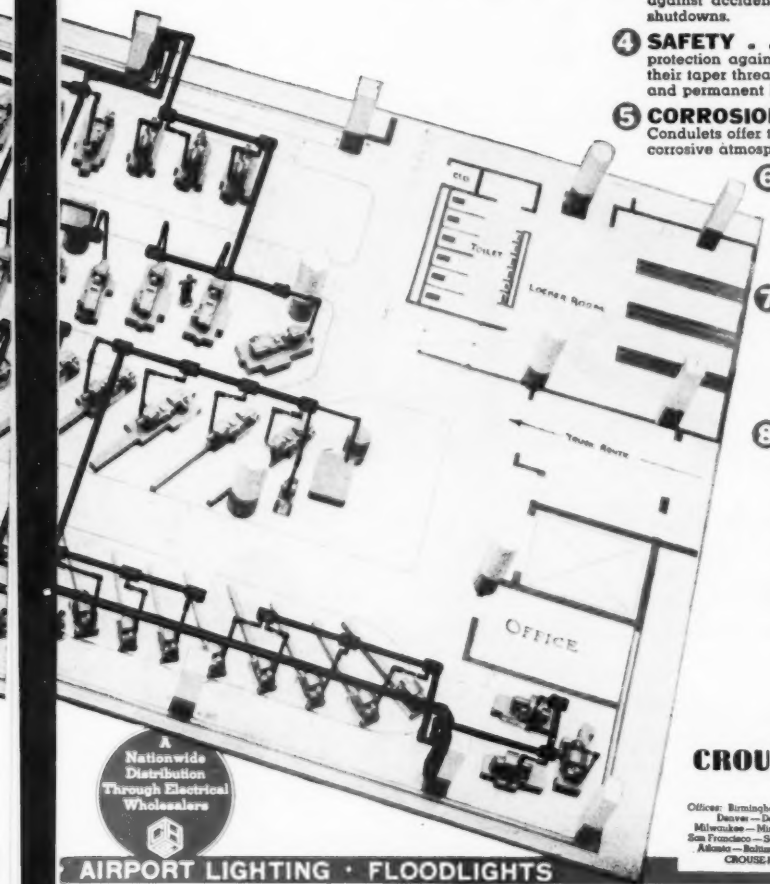


Enlarged view, showing how Type RSM Condulets provide for easy expansion... branch circuits can be added at any time. Simply replace a blank plate with a plate that has the required number and size of hubs.

CONDULETS · TRAFFIC SIGNALS

method gives YOU definite advantages!

NEW ways of using the familiar Condulet and conduit material have produced outstanding results. Modern installation layouts meet industry's modern needs for flexibility while retaining the enduring protection and safety that can only be given by cast Feraloy Condulets and rigid conduit.



A Nationwide Distribution Through Electrical Wholesalers

AIRPORT LIGHTING · FLOODLIGHTS

1 FLEXIBILITY . . . A modern Condulet installation, like the one illustrated below, provides for the vigorous growth and changing conditions of a modern industry. The RS Series Condulets with their detachable hub plates make it easy to change circuits or add additional circuits at any time.

2 UNIVERSAL APPLICATION . . . Galvanized Condulets and galvanized rigid conduit may be used under all atmospheric conditions and occupancies.

3 MECHANICAL PROTECTION . . . Cast Feraloy Condulets and rigid conduit provide the best possible protection against accidental damage to the wiring — prevents costly shutdowns.

4 SAFETY . . . A Condulet installation gives maximum protection against personal injury and fires. Condulets with their taper threaded hubs and rigid conduit provide a reliable and permanent low resistance path to ground.

5 CORROSION RESISTING . . . Cast Feraloy Condulets offer the best protection wherever moisture, dust or corrosive atmospheres are present.

6 ECONOMY . . . Direct comparison of Condulet and rigid circuit installations with other wiring methods show comparable installed costs. The durability, safety, and low maintenance cost of Condulet installations produces savings which pay dividends over the years.

7 QUALITY . . . All Condulets are built to Crouse-Hinds' high standard of quality with painstaking care by skilled craftsmen. Thousands of Condulet installations that are still in active service after twenty, thirty, forty or more years offer positive proof that the trademark CONDULET stands for reliability and long life.

8 VARIETY . . . Thousands of types and sizes of Condulets, plugs and receptacles, and lighting fixtures are listed in the Condulet Catalog, including a complete explosion-proof and dust-tight line for use in hazardous locations. There is a Condulet for every purpose.

On your next electrical layout, whether modernization or new construction, plan to get all of the benefits of sturdy cast Feraloy Condulets and rigid conduit. Send for additional information on modern Condulet installation.

*CONDULET is a coined word registered in the U. S. Patent Office. It designates a product made only by the Crouse-Hinds Company.

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Syracuse 1, N. Y.

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Don't be a FIXTURE PICKER!

Appearance isn't everything. The price tag isn't the whole story. *Lighting is a science.*

It takes the right equipment, certainly. It also takes expert planning in the application of this equipment to give you the BEST BUY IN LIGHTING. You know that, of course, but how many others do?

Good lighting, combined with practical economics, takes the services of a qualified lighting engineer.

Whether you plan lighting, buy lighting or install lighting, ask for the services of a Westinghouse lighting engineer. J-04283

Westinghouse
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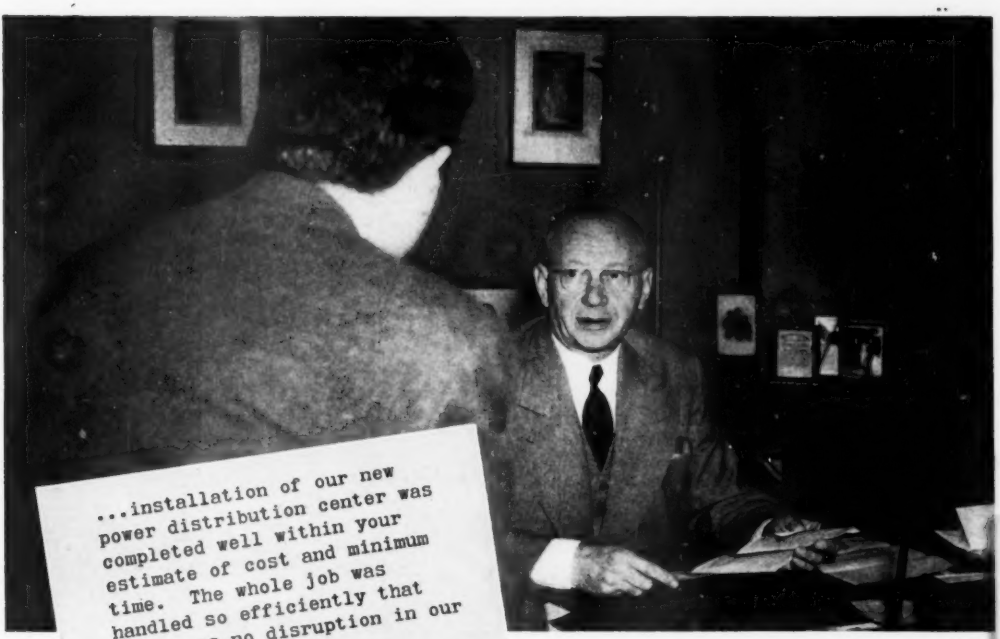
PAYS


...installation of our new power distribution center was completed well within your estimate of cost and minimum time. The whole job was handled so efficiently that there was no disruption in our normal operation...

—from a letter to Henry F. Fischbach of Fischbach and Moore, Inc., Electrical Contractors

"That's the kind of a letter I like to get!"

Of course . . . Fischbach and Moore chose Qiklugs for this job—one of the quick-action, high-strength Burndy connectors that prove, again and again, *good connections make good customers!* There's a Burndy connector that's better-built for *every* job. Ask your Burndy distributor.

BURNDY

QIKLUG

rugged • compact • versatile • need no special tool quick

Small, neat, easy-to-work-with. Speedy installation—tighten the single nut with the ordinary wrench you always have on hand! Cool—cast of high-conductivity alloys. All contact surfaces grind-finished. All parts corrosion-resistant. Each unit takes convenient range of conductor sizes.

BURNDY

1—1 *Burndy Engineering Co., Inc., New York 54, N. Y. • Western Branch: Vernon 58, Calif. • Burndy Canada Ltd., Toronto 8, Ontario*

A. B. Sutherland Company, Lawrence, Mass. Lighting Engineer: H. R. Loeschner, Lawrence Gas & Electric Co. Lighting Consultant: Ralph L. Huse, Graybar Electric Co., Boston, Mass. Contractor: Lawrence Electric Supply & Construction Co. Fixtures: Litecontrol No. 5928 8 foot slimline, No. 5926 6 foot slimline, and No. 5924 4 foot slimline fixtures, with No. 9015 Holophane Controlenses.* Litecontrol No. 5900—22 adjustable supplementary Spotlites. Watts per square foot: 3.8 (slimline only). Average intensity on counters: 60 footcandles in service.

Light! Bright!! and $ales Right!!!

This department store is light in a cheerful way . . . bright, but not "glarey" . . . *right,* in the way that makes cash registers ring.

Looks like a brand new store, doesn't it? Actually, it's a dramatic example of what skillful remodeling can do. Design is simple, neat, fully integrated with the unobtrusive Litecontrol Recessed Fixtures.

Spotlites are arranged in the rows to give extra light exactly where needed. And even the spotlites are recessed to keep the ceiling smooth and attractive.

To save time and trouble . . . to get results you'd be willing to advertise . . . call in LITECONTROL on your next lighting problem.

Why not write *today!*

*® HOLOPHANE CO., INC.

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DESIGNERS, ENGINEERS AND MANUFACTURERS OF FLUORESCENT LIGHTING EQUIPMENT DISTRIBUTED ONLY THROUGH ACCREDITED WHOLESALERS

DUTCH BRAND PLASTIX *Electrical tapes*

Available in practical sizes and packaging for contractors and industrial users.

Regular .007 Plastix for general service or .010 Plastix for Heavy Duty

The newest electrical tape in the line . . . High Dielectrical Resistance per mil of thickness . . . conforms readily to irregular surfaces. You'll find it an ideal tape for use in those many places where space is limited. **PLASTIX** stands up under severest conditions and resists water, oil, acids, alkalies and corrosive chemicals.

The new .010 **PLASTIX** Electrical Tape is slightly thicker for heavy duty work such as winding heavy cables, electrical harness or for use with power driven taping machines.

Both DUTCH BRAND **PLASTIX** ELECTRICAL TAPES are the result of careful study and research and meet the recognized high quality standards established by all other DUTCH BRAND electrical tapes.

For complete satisfaction order DUTCH BRAND **PLASTIX** ELECTRICAL TAPE by name . . . specifying either the regular .007 **PLASTIX** or heavy duty .010 **PLASTIX**.

REGULAR **PLASTIX** FEATURES THESE MANY OUTSTANDING QUALITIES

Tears Readily . . . in spite of its strength and stretch.

Conforms to Irregular Surfaces . . . great flexibility and stretch make excellent conformity.

Resists Weather . . . rain and rough weather do not affect it . . . favorably withstands relatively high or low temperatures.

Resists Oils, Acids, Alkalies, Corrosion . . . wherever present . . . in chemical plants, around machinery, etc.

High Dielectric Resistance, where space is limited . . . a single thickness resists 8000 volts which is greater than 1000 volts per mil of thickness.

Excellent Adhesion . . . the quality of the adhesive and the even coating assure excellent adhesion.

Tensile Strength . . . it is strong . . . has ample strength for all types of applications.

.010 **PLASTIX** ELECTRICAL TAPE CHARACTERISTICS

All general characteristics are the same as above except .010 PLASTIX is heavier gauge for heavy-duty work.

Thickness .010"
A single thickness resists 10,000 volts

the "Dutch Brand" trio

The Three Electrical Tapes
Friction — **PLASTIX** — Rubber
to meet all requirements

ORDER FROM YOUR JOBBER

DUTCH BRAND

VAN CLEEF BROS. INC.
Manufacturers . . . Rubber Products . . . Est. 1910
CHICAGO 19, U. S. A.

Shake hands with

STATION SHOWN IS ACTUAL SIZE

another Edwards WINNER

It's the first really new
FIRE ALARM STATION
in the last 20 years

1. *A "must" for most new buildings—especially new schools and hospitals*

Once again Edwards justifies its position of leadership! This time with the first *really new* fire alarm station in 20 years. It's a streamlined beauty entirely new in design—providing vastly improved operating efficiency, new ease of maintenance and important installation economies. The smallest and most decorative code station available today, it literally "hugs the wall" with a maximum projection of only 1⅞".

2. *Really new installation economy—cuts man-hour installing costs up to 30%*

Radically improved and simplified design makes installation and wiring quick, easy and certain. No more juggling of box in order to make difficult lead-wire connections to back box terminal. Unlike old-fashioned stations, all new Edwards stations (including break-glass type) have terminal blocks that are front connected and therefore readily and easily accessible. Elongated screw holes permit easy alignment of box on wall. Up to 30% savings on man-hour installing costs mean extra profits and better jobs.

3. *Really new fool-proof operation PLUS ease of testing for simplified maintenance*

Streamlined simplicity of operation—one simple pull of handle assures positive operation. Even in Break Glass model, there's no chance of "operation failure" because of haste or panic. Streamlined simplicity of testing, too. New hinged front drops down exposing entire mechanism in protective plastic cover. *All* new Edwards stations can be tested for both silent and audible operation while front is down. No special, easily misplaced keys needed to open or test—a screwdriver does it all—quickly and easily!

EDWARDS

World's most reliable time, communication and protection products

EDWARDS COMPANY, INC., NORWALK, CONN. *In Canada: Edwards of Canada, Ltd.*

You can't buy Better Fittings or ones that cost less to use

Cross Section Showing Indentations.

Quicker to use and neater in appearance, Briegel All-Steel Indenter Fittings not only make stronger connections but also make each job more profitable to the contractor and satisfactory to his customers.

Two Easy Squeezes and they're set to stay. It is only natural that the Briegel All-Steel Indenter Fittings are the most widely used E.M.T. connectors and couplings. Contractors the world over recognize their cost cutting qualities and the fact that they make each wiring job neater, stronger and better.

All B-M Fittings Carry the Underwriters Seal of Approval

BRIEGEL METHOD TOOL CO.

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Century 1/8 TO 3/4 H. P. MOTORS

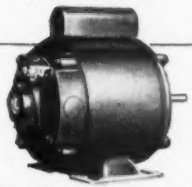
Choose From These Many Types to Fit Your Job

HEAVY-DUTY for Industrial and Appliance Use

From Century's wide range of types and sizes, there's a proper motor for all popular applications. You can be confident that the right Century motor will assure a long life of satisfactory performance.

Shown here are examples of Century's line of FRACTIONAL HORSEPOWER motors—ruggedly built for smooth, quiet operation, with a remarkable freedom from vibration

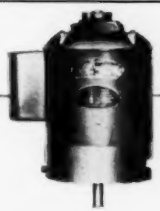
Century Electric Company is celebrating its 50th year in the electrical industry.



TYPE CSH — Capacitor Start Induction Single Phase Motor suitable where high starting torque and normal starting current is satisfactory.

TYPE SP — Split Phase Induction, Rigid Base, Single Phase Motors suitable for light starting duty.

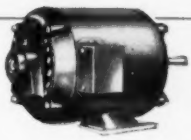
TYPE SC — Squirrel Cage Polyphase Motor built in fractional sizes for all torque requirements.



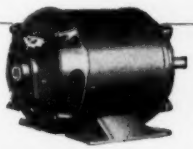
JET PUMP MOTOR—Capacitor Start Single Phase Motor available in sizes for practically every jet pump application.

TYPE SP — Split Phase Induction, Cushion Base, for quiet operation.

OIL BURNER MOTOR especially designed for this service. Compact, rugged; smooth, quiet starting and running.

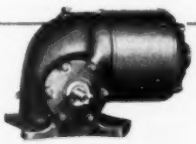


TYPE RS — Repulsion Start Induction Single Phase Brush Lifting Motor suitable for applications requiring high starting torque and low starting current.



TYPE DM — Direct Current built in sizes and ratings for applications where direct current is available or its use desirable.

UNIT HEATER MOTOR provides smooth, quiet performance throughout a long service life.



GEAR MOTOR, compact, rugged, ball bearing equipped, for your high torque, slow speed requirements.

The complete line of Century motors includes a wide range of types and kinds, from 1/8 to 400 horsepower. They are available in open rated, splash proof, totally enclosed fan cooled and explosion proof frames.

Specify Century motors for all your electric power requirements.

CENTURY ELECTRIC CO.

1806 Pine Street
St. Louis 3, Missouri

OFFICES AND STOCK POINTS IN PRINCIPAL CITIES

-682

FOR MAXIMUM WIRING CONVENIENCE

THE ANSWER IS BRYANT

WITH THE BRYANT 4832 OUTLET

No. 4832—15 Amperes 125 Volts
10 Amperes 250 Volts

The Bryant 4832 is a high quality duplex convenience outlet designed for lifetime service in residential and commercial installations.

FEATURES—Double-sided contacts, which securely grip the cap blades for positive electrical contact. All bakelite construction.

Large, terminal binding screws facilitate wiring and will accommodate up to No. 10 conductors.

Locked-in yoke has washer type plaster ears.

Double "T" slots for all types of caps . . . parallel, tandem, double "T" or polarized.

Slot-finding feature facilitates cap insertion.

Meets all specifications.

This device available for two-circuit installations for switch control of one outlet. No. 4832-X designed for two feeds and two returns . . . No. 4832-Y for two feeds and one return.

Available in brown and ivory.

Listed as Standard by Underwriters' Laboratories, Inc.

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THE BRYANT ELECTRIC COMPANY

Bridgeport 2, Connecticut

CHICAGO • LOS ANGELES

Specify Bryant Devices from Your Electrical Wholesaler.

J99851

TRI CLAD MOTORS
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will run safely without relubrication for as long as any general-purpose motor you can buy—
and if the application makes relubrication a must, you can grease a TRI CLAD without halting production
GENERAL ELECTRIC
HERE'S WHY

TRI CLAD MOTORS will run safely without relubrication for as long as any general-purpose motor you can buy—

Tri-Clad extra lubrication "protection" can save you money because:

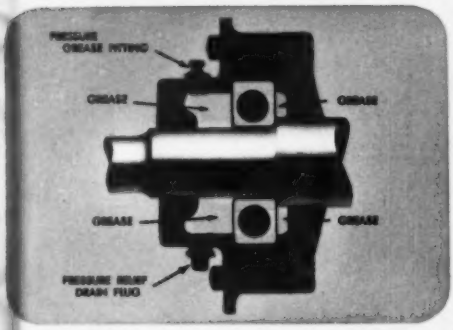
1. Tri-Clad's oversize grease reservoir and the heaviest standard-service bearings mean you do not have to bother with greasing between motor check-ups.

2. When relubrication is needed on those tough applications, you can grease a Tri-Clad without interrupting production-line operations.

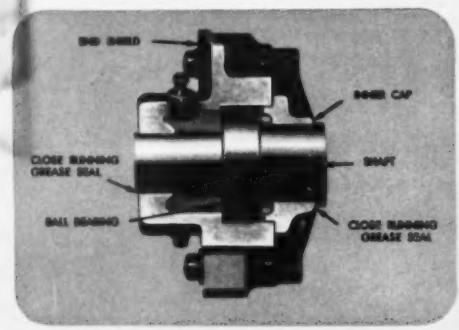
Tri-Clads are grease-gun easy to lubricate *on the job*. Moreover, a Tri-Clad motor will run safely where an ordinary motor would fail. Chances are you'll be spared the cost of a "special" motor.

YOU BE THE JUDGE! The best way to prove to yourself that Tri-Clad gives you the most for your motor dollar is to contact your local G-E office. Tri-Clad stocks are complete. *Apparatus Dept., General Electric Company, Schenectady 5, N. Y.*

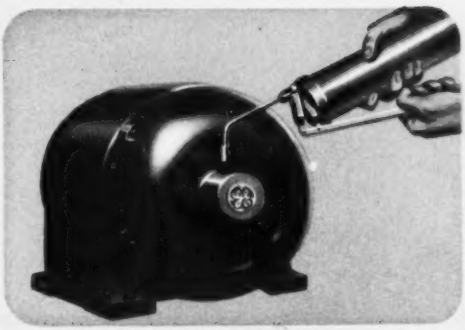
1 **EXTRA BEARING PROTECTION** — Tri-Clad gives you extra bearing protection because heaviest standard-service bearings are carefully selected to withstand severe loads for long periods.



2 **EXTRA GREASE** — Four times the ordinary amount of grease is packed into the large Tri-Clad grease reservoir. Since bearing life depends on grease, this means that Tri-Clad motors will run safely for years — for as long as any general-purpose motor you can buy.



3 **SEALED-IN BEARINGS** — Bearings and grease are completely sealed in a cast housing with long running seals for extra protection from dirt, dust, and lubricant leakage.



4 **PRESSURE-RELIEF GREASING** — An efficient system of pressure-relief lubrication (with standard fittings) enables a Tri-Clad motor to be quickly and easily greased on the job when and if it's needed.

GENERAL ELECTRIC

MAGNET WIRE

Roebling Roevar is absolutely tops for high speed winding

THE INSULATION of Roevar Magnet Wire is 10 to 40 times tougher – 10 to 40 times more abrasion-resistant – than other insulations. More than that, it bends and stretches remarkably without cracking or working loose from the conductor . . . has high resistance to baking temperatures and to the solvents in varnishes. Roevar Magnet Wire also has a smaller overall diameter than wire with enamel, silk, cotton or paper insulation . . . and it costs less, too!

A large part of Roebling's complete line of electrical wires and cables is required in the national drive for rearmament, but we'll always do the best we can on service and deliveries. Write today for full data and samples of Roevar. John A. Roebling's Sons Company, Trenton 2, New Jersey.

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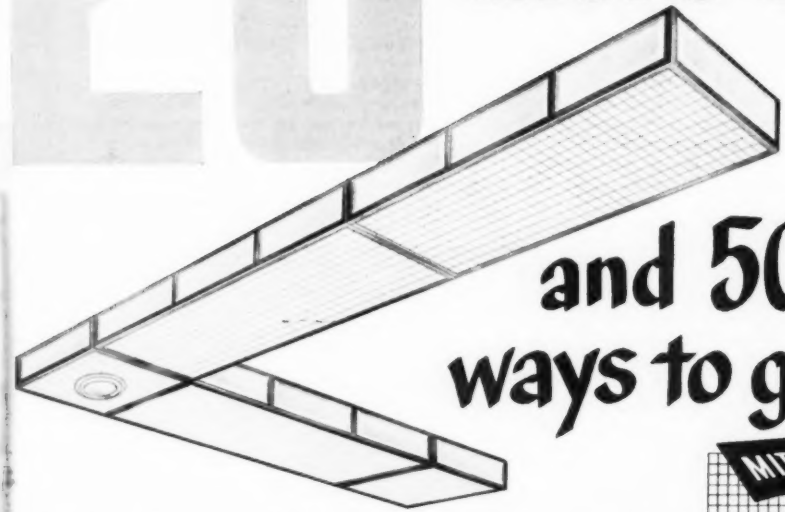
Atlanta, 934 Avon Ave ★ ***Cambridge,*** 31 Carleton St ★ ***Chicago,*** 5525 W. Roosevelt Rd ★ ***Cincinnati,*** 3253 Fredonia Ave ★ ***Cleveland,*** 701 St. Clair Ave, N.E. ★ ***Denver,*** 4801 Jackson St ★ ***Houston,*** 6216 Navigation Blvd ★ ***Los Angeles,*** 216 S. Alameda St ★ ***New York,*** 19 Rector St ★ ***Odessa, Texas,*** 1920 E. 2nd St ★ ***Philadelphia,*** 230 Vine St ★ ***San Francisco,*** 1740 17th St ★ ***Seattle,*** 900 1st Ave, S. ★ ***Tulsa,*** 321 N. Cheyenne St

20% more light



and 50,000 ways to get it

that's the lighting magic of MITCHELL module

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20% MORE LIGHT! This department store MODULE installation delivers 60 footcandles. To obtain the same light output with ordinary fixtures, 20% more units would be needed.

Yes, MODULE's exclusive Polystyrene plastic louver passes 20% MORE LIGHT than conventional metal louvers—saves more lighting dollars in *any* installation. And with just 4 simple, low-cost "building blocks of light," MODULE creates *unlimited* custom-fitting lighting patterns to fit *any* commercial interior. Because MODULE units fit together simply (both mechanically and electrically), patterns can be rearranged to suit changing needs—*at minimum cost.* MODULE's styling is enduring; stays beautiful, new. No ordinary fixtures can match MODULE—the *only* lighting system that delivers *20% more light,* that *custom-fits* any commercial installation at *lowest cost.*

20% MORE LIGHT! In this modern drug store, MODULE attains a 96 footcandle output. An equivalent number of conventional fixtures would deliver only 80 footcandles.

20% MORE LIGHT! Here is MODULE in an appliance store, delivering 70 footcandles. Using the same number of ordinary fixtures, only 58 footcandles would be obtained.

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Features the best of material carefully fabricated to provide maximum mechanical protection. Available in Standard and A.S.T.M. grades.

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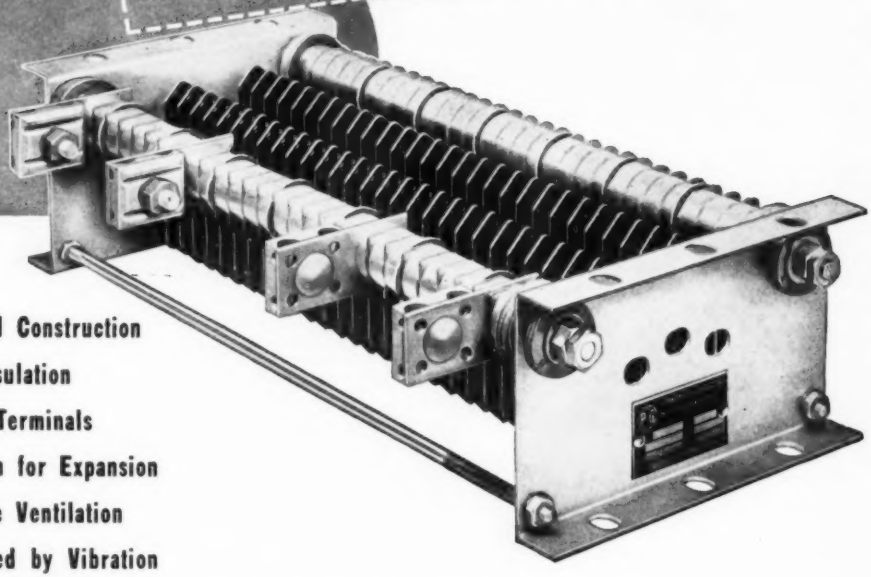
P-G... Nonbreakable STEEL GRID Resistors



All Steel Construction
Mica Insulation
Rugged Terminals
Provision for Expansion
Adequate Ventilation
Unaffected by Vibration
Moisture Resistant
Corrosion Protected

These Post-Glover Standard Resistor Units will increase production equipment availability thru reduction in motor maintenance and machine hours lost from electrical failures. P-G Steel Grid Resistors are rugged because they are built of steel and mica. Add to this, sound resistance values with ample capacities and failures due to resistor trouble cease to exist. Specify P-G for your next application, especially, if your operating conditions are severe.

P-G

The Nonbreakable Steel Grid Resistor

THE POST-GLOVER ELECTRIC COMPANY

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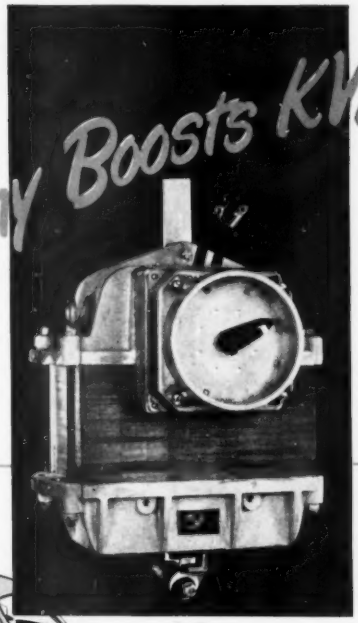
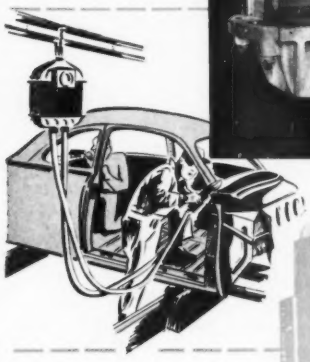
221 WEST THIRD STREET, CINCINNATI 2, OHIO

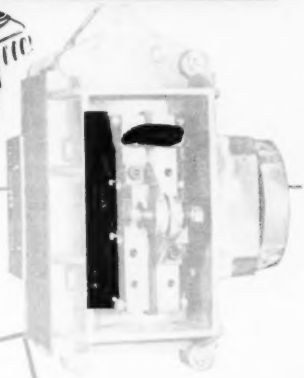
McCarthy Boosts KVA Rating 30%

with

NATVAR VARNISHED FIBERGLAS







This McCarthy Type 525-PG welding transformer is compact and weighs only 458 pounds, yet it is rated 75KVA, 220 or 440 primary volts (not interchangeable), 60 cycle, 1 phase, 108°C temperature rise, at 50% duty cycle. An extra heavy heat selector switch gives secondary voltages in eight steps from 5.00 to 9.16, parallel connection, or 10.0 to 18.32, series connection.

Primary coils are insulated between turns with Natvar varnished Fiberglas tape, dipped and baked. The wound coil is then insulated with mica and Natvar varnished Fiberglas tape, again dipped and baked, and finished with air drying varnish. Secondary coils are heavy wall square copper tubes through which cooling water circulates. Leads are insulated and protected with Natvar 400 heat resistant extruded vinyl tubing.

McCARTHY ELECTRIC CO., Detroit, manufactures welding transformers used extensively on production lines in the automotive industry for welding bodies and various fabricated parts, and in the refrigerator industry for welding boxes. Since it is more practical to weld large assemblies with guns rather than on stationary machines, portability is important. Size and weight of the transformer must therefore be kept at a minimum. And because many of these units are in continuous service 24 hours a day, long life is important, too.

By designing and building these transformers for higher continuous operating temperatures, McCarthy has succeeded in raising capacity 30% without increasing the size or weight. McCarthy has standardized on Natvar varnished Fiberglas and Natvar 400 Extruded Vinyl Tubing because of their uniformly high resistance to heat, and because both have exceptional aging characteristics, which means longer life.

All Natvar flexible insulations are consistently uniform, no matter when or where purchased. They are immediately available either from your wholesalers' stocks or direct from our own.

Natvar

Natvar Products

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- Varnished canvas
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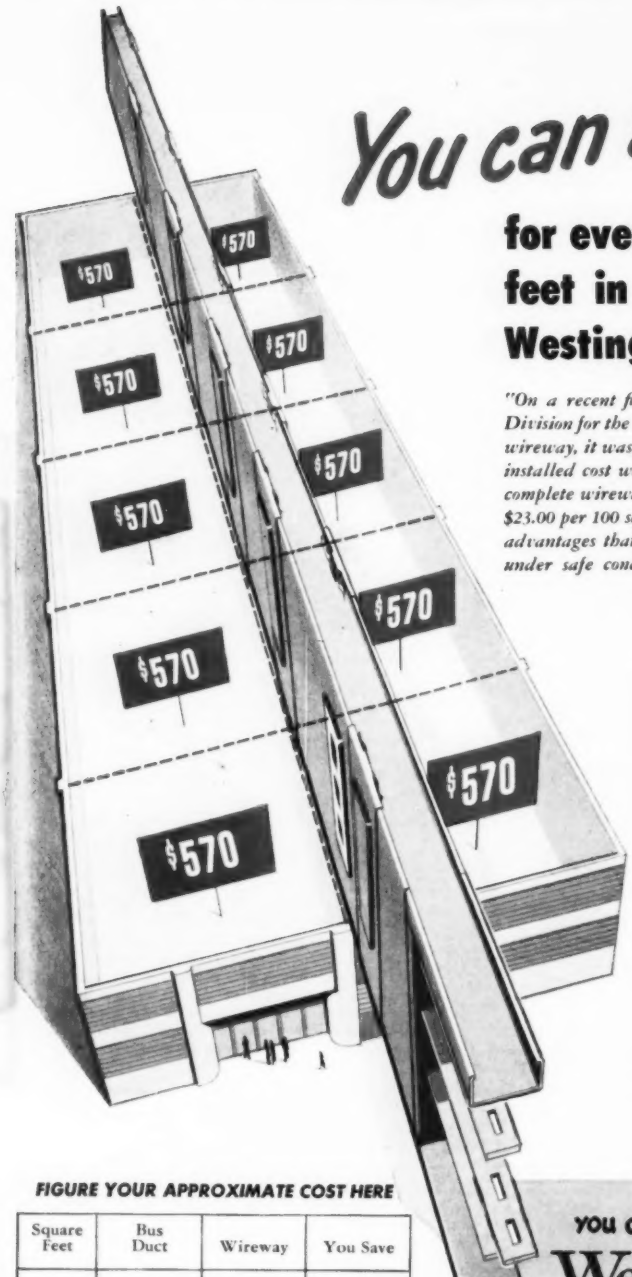

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"On a recent field survey made by our Sales Engineering Division for the application of 440-volt plug-in bus duct versus wireway, it was found that for a complete bus-duct system the installed cost was $17.30 per 100 square feet, whereas for a complete wireway system with taps, the cost was estimated at $23.00 per 100 square feet. This cost does not evaluate all the advantages that plug-in duct offers for ease of making taps under safe conditions without shutdown."

The Buffalo Electric Co., Buffalo, N. Y.

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Many plants have found in Westinghouse Bus Duct a system of power distribution impossible to match for low installed cost and high carrying capacity in limited space.

Westinghouse Duct, in completely prefabricated sections, varying in length to suit requirements, is convenient to handle and easy to hook up. The longer the run, the greater the saving.

And Duct is easily disassembled for quick expansion or changeover—critical today when equipment must operate at uninterrupted top capacity, top efficiency.

Experienced Westinghouse Field Engineers can help you plan your secondary power distribution system. Phone your nearest Westinghouse Office, or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa.

J-30046

FIGURE YOUR APPROXIMATE COST HERE

Square Feet	Bus Duct	Wireway	You Save
1,000	$ 173.00	$ 230.00	$ 57.00
10,000	1,730.00	2,300.00	570.00
20,000	3,460.00	4,600.00	1,140.00
50,000	8,650.00	11,500.00	2,850.00
100,000	17,300.00	23,000.00	5,700.00
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DESIGN TESTED AND VERIFIED IN THE Westinghouse HIGH POWER LABORATORY

YOU CAN BE SURE.. IF IT'S Westinghouse BUS DUCT

WESTINGHOUSE

Desk Fans

MODEL 362—50-60 cycle, 10" oscillator, 1-speed, delivers 700 C.F.M., opalescent Windsor green finish.

MODEL 1049—50-60 cycle, 10" oscillator, 1-speed, delivers 600 C.F.M., light tan finish.

MODEL 481—25-60 cycle, A.C. or D.C., 10" oscillator, 2-speed, delivers 600 C.F.M. on D.C., blue-gray finish.

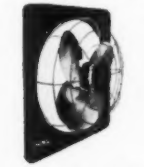
MODEL 361—60 cycle, 12" oscillator, 3-speed, delivers 950 C.F.M., black wrinkle finish.

MODEL 1249—50-60 cycle, 12" oscillator, 2-speed, delivers 850 C.F.M., opalescent Windsor green finish.

MODEL 1231—50-60 cycle, 16" oscillator, 3-speed, delivers 1500 C.F.M., glossy black enamel finish.

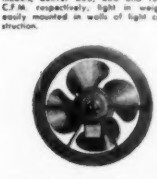
MODEL 1649—50-60 cycle, 16" oscillator, 3-speed, delivers 1250 C.F.M., opalescent Windsor green finish.

Exhaust Fans



***NEW* Model V-520A Challenger Vent Fan**—50-60 cycle, 20" guarded blade, rubber mounted, delivers 3300 C.F.M., black wrinkle finish, operates in either vertical or horizontal position.

Model V-310, V-312, V-316 Challenger Vent Fans—10", 12" and 16" models, deliver 600, 850 and 1500 C.F.M. respectively, light in weight, easily mounted in walls of light construction.



Model V-108 Signal Ring Type Vent Fan—feather-weight model can be mounted on wallboard, features 10" quiet-type fan blade and cast aluminum mounting ring, delivers 700 C.F.M.

Model V-312, V-316, V-318 Signal Bucket Blade Exhaust Fan—12", 16" and 18" models, deliver 840 C.F.M. zero static pressure—1200 C.F.M. free air delivery, 1260 C.F.M. zero static pressure—1800 C.F.M. free air delivery, 2030 C.F.M. zero static pressure—2900 C.F.M. free air delivery respectively, has fully enclosed, shaded pole, thrust-type ball bearing motor, operates in either horizontal or vertical position.

Model V-1234 Signal Bucket Blade Exhaust Fan—24" model, 2-speed, delivers 4000 C.F.M., has ⅙ h.p. thrust type ball bearing capacitor motor, operates in either horizontal or vertical position.

Pedestal Fans

MODEL P-1251—50-60 cycle, 16" oscillator, 3-speed, delivers 1500 C.F.M., blue-gray wrinkle finish, telescopic floor stand provides height adjustment from 4' 6" to 7' 6"—floor to center of fan.

MODEL CF-20A Air Circulator—60 cycle, 20" blade, 2-speed, delivers 3300 C.F.M., telescopic floor stand provides height adjustment from 4' 4" to 7' 6"—floor to center of fan, wing nuts allow fan to be tilted—varying angle of operation from vertical to 15 degrees below horizontal, in 15 degree angles.

COOL SPOT
SIGNAL
MADE BY SIGNAL
the FANS for '51
Designed Right · Built Right · Priced Right
Here's a ready reference showing the famous Signal and Coolspot Fans . . . a complete line—your assurance of profitable, year 'round fan sales.

Floor Fans

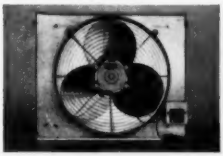
MODEL FF-12 Secretaire—50-60 cycle, 12" floor fan, 3-speed, delivers 2400 C.F.M., beverage resistant, hand-rubbed, wood cabinet, walnut finish.

Kitchen Vent Fans

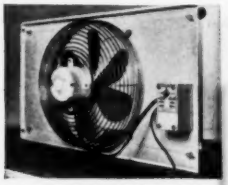
MODEL V-30A Wall Fan—50-60 cycle, 10" blade, 1-speed, delivers 650 C.F.M., finish inside frame and door white baked enamel, balance brown enamel, shutters aluminum. Available in A.C. or D.C. models and to fit wall thicknesses up to 24".

Window Fans

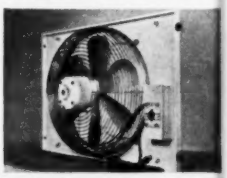
MODEL W-101—50-60 cycle, 10" blade, 1-speed, switch in cord, delivers 700 C.F.M., non-reversible.



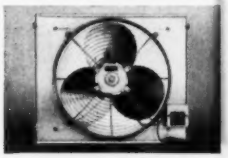
MODEL W-201—50-60 cycle, 20" blade, 3-speed, switch on panel, delivers 3300 C.F.M., non-reversible.



Model WR-122 Electrically Reversible Window Fan—50-60 cycle, 12" blade, 1-speed each way, switch on panel, delivers 900 C.F.M. in both directions.



Model WR-162 Electrically Reversible Window Fan—50-60 cycle, 16" blade, 2-speeds each way, switch on panel, delivers 1500 C.F.M. in both directions.



Model WR-202 Electrically Reversible Window Fan—50-60 cycle, 20" blade, 2-speeds each way, switch on panel, delivers 3300 C.F.M. Exhaust (intake slightly less).

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It will pay you well to sell *Signal* and *Coolspot* Fans in '51 . . . for Signal Fans are built to SELL and STAY SOLD! They don't come back for repairs which eat away your profits. Get the Signal story today!

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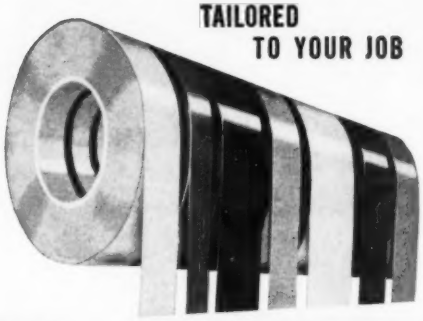

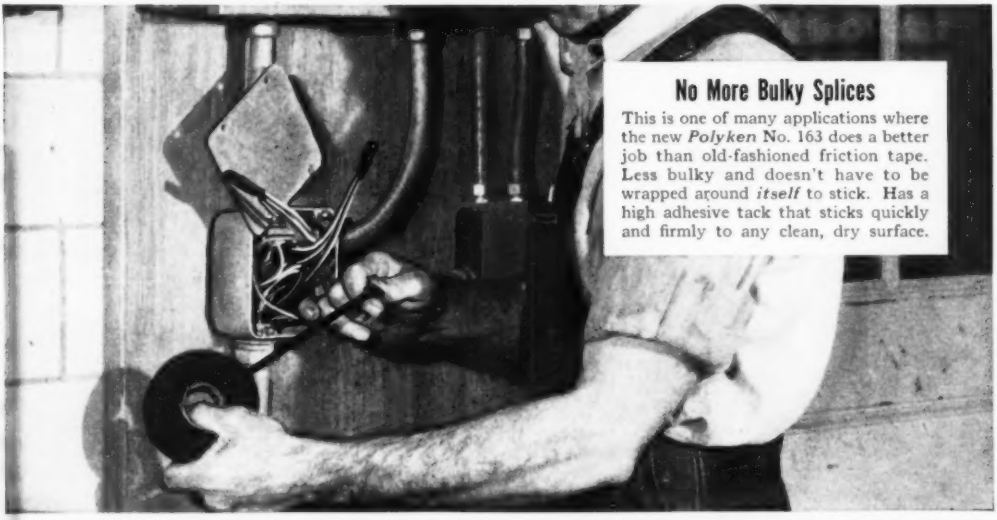

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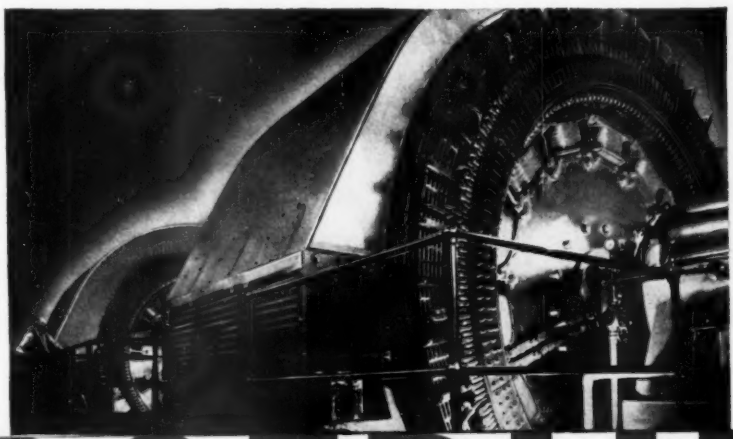

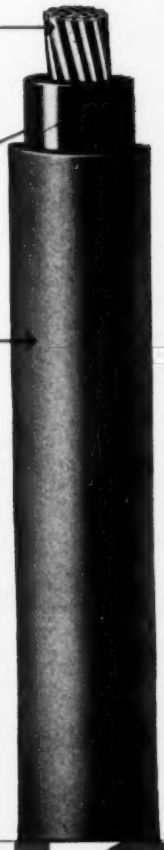

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Why the sea is salty

IN Norse mythology, a poor man got a magic mill from the elves. With it he could grind whatever he wanted--food, clothing, furniture, and best of all, gold. Of course, the poor peasant's lot changed from poverty to riches.

An envious brother borrowed the mill. He commanded it to "grind herrings and broth and grind them good and fast." But having taken the mill in such haste, he didn't know the magic words to shut it off. He was almost drowned in broth when the brother came to the rescue.

Finally, the magic mill was stolen by a salt dealer, who put it on his ship. Safely at sea, the skipper demanded, "Grind salt and grind it good and fast." Alas, he hadn't learned the control words either. The mill ground salt endlessly, filling all his kegs and his hold, covering the decks and at last sinking the ship. There at the bottom of the sea, so people say, the magic mill still grinds--and that's why the sea is salty.

From time immemorial, men have dreamed about magic mills and schemes to bring abundance and riches. Here in America, today, there are plans that are flooding us with superabundance of certain commodities. But what about the magic words to shut off the mill?

Isn't it time we see the truth in this ancient Norse myth, that "too much" is just as foolish as "too little?" We may well remember this first law of economics: In a *free* market, supply can adjust itself to demand--whether it be potatoes or steel--without sinking the ship. Here is a must job for all thinking Americans.

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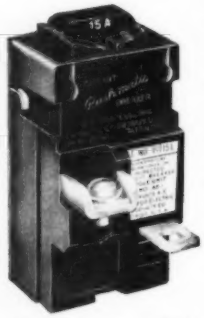

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FEBRUARY . . . . *at a Glance*

Washington Roundup

Defense mobilization activities are hitting a new stepped-up pace. The task ahead, affecting every American, has been clearly outlined. Policy generally has been set. Under C. E. Wilson's capable leadership, a carefully planned Defense Mobilization organization has been established, and specific activities assigned to each unit, or Agency. These coordinated efforts are all directed, first, to the vitally essential objective of physical armed strength as quickly as possible, and second, to an expanded industrial economy with minimum dislocations. The immediate aim is a U. S. mobilization of roughly 40 percent of an all-out effort.

- Shortages of metals and materials continue to increase—a controlled materials plan (CMP), scheduled for adoption about July 1, will relieve many present problems.
- Military spending is at an increasing rate.
- New bans have been placed on building construction. Some relief will be available through authorization of essential structures by regional control boards.
- Expanded military construction will relieve impact of present construction bans.
- Federal building programs will be substantial.
- For the complete story, turn to page 141.

Copper Limitation

Under order M-12 you may not use more than 85% as much copper in January and February and 80% as much in March as the average of your use during January through June of 1950. Yes, this means you! Until more specific orders affecting electrical conductors are issued, the electrical contractor must keep within this general limitation or he must apply through the Department of Commerce for a special directive.

To comply you must know how much copper, by weight, you used in the base period, and how much you are currently installing. Simplex Wire & Cable Co. has just issued a set of tables, specially prepared for the purpose, from which the net copper weight per 1000 feet of building wires is reproduced, on page 143.

Pre-Assembly Wiring

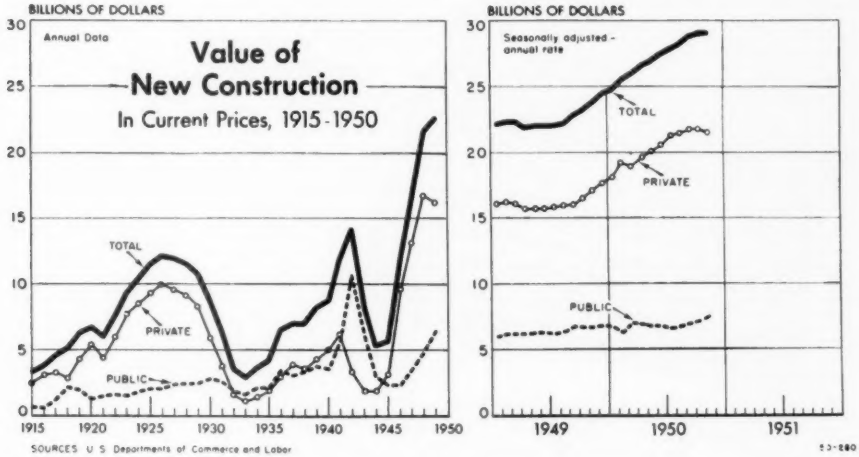
Mass production wiring techniques save on materials and labor on large housing developments, good business on peace time housing, even more important for the defense housing requirements that will be required under mobilization plans. The experience of Kuster-Wetzel Electric Company in developing efficient field organization, pre-assembly techniques and time saving tools on a large Long Beach, California housing development discloses useful know-how of timely importance. The story, "Wiring 17,000 Houses" begins on page 56.

Phasing Out

Before final connections, phase sequence or phase rotation must be checked from generator or incoming supply through the switchgear, and associated relays and instruments. R. E. Burlingame, electrical design engineer of J. F. Pritchard and Company, describes in "How to Phase Out Switchgear Connections", Page 53, a step by step procedure for handling the job, what instruments to use and how to use them.

Reciprocal License

Metropolitan areas surrounding big cities spread out over many towns and villages, each with its own local government, its own ordinances and license requirements. The Detroit area has solved the problem with a reciprocal license program based on uniform examination and code requirements. There a plan and procedure was organized that may well be the answer for many other communities with a similar multiple-license problem. See "Detroit's Reciprocal Licensing Program" on Page 62.



G-E Insulating News

News of electrical insulating developments from General Electric that can be important to *your* business.

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You can cut costs on insulation jobs by using the "perfect team" of General Electric insulating materials—G-E 9574-A All-purpose Insulating Varnish and G-E 1201 Glyptal* Red.

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ELECTRICAL CONSTRUCTION AND MAINTENANCE

50th Year —FEBRUARY • 1951

It Takes Time

PERCENTAGE CUTBACK in copper use is unworkable when applied to wiring. An accelerated program of power development and industrial expansion needs copper. The quantities needed are determined by the engineering realities. The amount used by a contractor in some past period of time has no bearing. But such problems are well known in D.P.A. and they will be solved. Until the Controlled Materials Plan takes hold on July 1, the present "DO" priority system will be elaborated or directives issued to take care of urgent needs.

COMPLAINTS of confusion in mobilization planning make lively reading. Individuals trying to link their business resources to evident needs run into maddening frustrations. Controls, like the commercial construction ban, hit some groups with extraordinary severity, while other obviously nonessential industries seem to chew up great quantities of precious critical materials with little, if any, apparent inhibition.

TO COUNSEL PATIENCE and restraint under such conditions is not in the popular vein. But forebearance was never more important. The translation of strategy into military materiel, production objectives into plant and finished materials, control policy into working orders takes a large organization of carefully selected people drawn from a great variety of industry experience.

BUILDING agencies and departments is slow work. It is still taking the time and energies of top men. And until control operations can be adequately staffed, there will be a thousand obvious inequities and apparent shortcomings to arouse the ire of special groups and individuals.

INTELLIGENT RESTRAINT does not call necessarily for silent suffering. Even in the formative stages agencies have to be responsive to real grievance. Often the most practical way to launch a control program is to lay down the law, then amend it by further directives as the working problems show up. But complaints should be about conditions which are clear and present.

UNDER THE LEADERSHIP of Charles E. Wilson, the direction, control, and coordination of all mobilization efforts are in able and experienced hands. Expression of his policies down the line will depend upon the manpower and channels which can be set up in the weeks ahead. In the meantime, unnecessary or impatient criticism only slows down the job.

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How to Phase Out Switchgear Connections

A discussion of several methods of checking phase sequence between generator and switchgear connections; also a suggested step-by-step test procedure.

By Robert E. Burlingame
Electrical Design Engineer
J. F. Pritchard and Company
Kansas City, Missouri

BEFORE final cable connections are made, or a circuit breaker is closed, between a three-phase generator (or other power source) and the associated switchgear, a careful check of phase sequence should be made. Phase sequence, also known as phase rotation, is the order in which positive voltage peaks occur on respective individually identified electrical conductors energized by a polyphase source. If the equipment is to operate properly, it is important that cable connections be correct.

In modern three-phase switchgear, individual phase busbars are identified by the numerals 1, 2, and 3. These indicate the sequence in which the positive voltage peaks occur on the respective busbars when one or more generators, or other three-phase power sources, have been correctly connected to the switchgear. The same numerals on terminal blocks of potential and current transformer secondary circuits indicate positive peak sequence of phase voltages and currents in the instrument transformer secondaries and also the phase relationship between the high voltage and instrument transformer secondary circuits.

Switchgear arrangement drawings have the same numerals to show the physical locations of the respective phases of incoming and outgoing primary circuit terminals. On switchgear wiring diagrams, the numerals 1, 2, and 3 identify the phase wires of all instrument transformer secondary circuits throughout their connections to switchboard instruments, meters, relays and generator voltage regulators. Many of these devices will operate properly with a reversed phase sequence of delivered voltage and current. Other devices will function incorrectly under such conditions.

As an example, a voltage regulator for a generator operated in parallel with one or more other generators will not function properly if the phase sequence established in the switchgear is reversed from that on which the switchgear wiring was based. In this case, the regulator's cross-current compensating feature, which normally stabilizes the regulator and automatically prevents cross currents between generators, will have an opposite effect. It will create dangerously high cross currents between generators. Certain other instruments and relays will not function properly under reversed phase sequence.

The main terminals of a three-phase generator are marked T1, T2 and T3. When three additional terminals are provided to make external neutral connections between the generator windings, they are marked T4, T5 and T6. One phase winding is connected between terminals T1 and T4; another between T2 and T5; and the third between T3 and T6. The T1, T2, and T3 terminal markings do not necessarily indicate the phase sequence at the generator terminals. According to standard rules, phase sequence at generator terminals may be either T1-T2-T3 or T3-T2-T1, depending upon direction of generator rotation and the physical location of the terminals on the unit.

Phase-Out Methods

Switchgear connections must be right before the associated circuits are energized. Although terminal identification and phase sequence, in terms of terminal numbers, are shown on generator drawings, it is highly advisable (and recommended by manufacturers) to make careful, thorough phasing-out tests before putting the equipment in operation. There are several methods of making such tests.

Transformer and Lamp Method

An old method of checking phase relation between a generator and a live bus uses a circuit with temporary connection of several spare potential transformers and three lamps as shown in Fig. 1 and Fig. 2. After the generator is brought up to approximately rated voltage and frequency, the action of the three lamps is observed. Since generator and bus frequency will not match exactly, each of the lamps will vary periodically between full brightness and complete darkness.

Generator phase sequence, as delivered to the switchgear, matches the phase sequence on the bus when all three lamps go through their cycles of brightness and darkness in unison. If the three lamps do not brighten and dim in unison, the generator phase sequence is reversed relative the phase sequence on the bus and two of the three generator leads must be interchanged. The hazards of temporary high voltage connections and the need for spare potential transformers can sometimes be eliminated by using the circuit shown in Fig. 2, if permanent potential transformers are suitably located in the switchgear.

The method of Figs. 1 and 2 merely enables matching the generator phase sequence with the bus phase sequence. It has these distinct disadvantages: 1) It does not determine what actual phase sequence exists; 2) it does not show whether or not the actual phase sequence previously established on the bus is correct; 3) it cannot be used to establish proper phase sequence in switchgear when connecting the first generator or incoming line to the switchgear.

Phase Sequence Indicator

The phase sequence indicator is a device which overcomes the disadvantages listed above; identifies and establishes correct phase sequence; combines compact, portable test equipment with low voltage temporary connections. Various forms of this instrument, also known as a phase rotation indicator, are commercially available.

One form includes a small reactor and two small incandescent lamps. A second form comprises a small capacitor and two small neon lamps. A third, uses an electromagnetic assembly and a rotating disc. Each of the first two forms contain internal multiplier resistors connected to terminals for use on voltages from 100 to 440 or 550 volts. The rotating disc type operates on the same voltage range without the need for internal multiplier resistors.

In each of the first two forms, when the device is connected to a three-phase potential source, one of the two lamps will burn brightly and the other will dim or go out completely. Phase sequence 1-2-3 will cause one lamp to burn brightly, while under the 3-2-1 sequence the other lamp will be bright. With the rotating disc type of indicator, the disc rotates in one direction to indicate the 1-2-3 sequence; in the other direction for the 3-2-1 relationship.

If a commercial instrument is not at hand, a reliable phase sequence indicator can be made easily from readily available component parts. A circuit diagram is shown in Fig. 3. The two lamps are identical 110 to 120-volt incandescent lamps of three- to 10-watt size. The iron core reactor can be the potential coil of a watthour meter or relay, the primary winding of a bell ringing transformer (the secondary is left open-circuited) or a filter reactor of the type used in small radio receivers. The lamp check switch can be any normally-open pushbutton or small switch. This indicator is suited for use on the secondary circuits of potential transformers, but may be adapted for 220 or 480-volt operation by connecting one or more additional lamps (or a suitable resistor) in series with each of the lamps shown in the diagram.

To use the indicator shown in Fig. 3, connect its terminals 1, 2, and 3 to a three-phase potential source. Momentarily close the lamp check switch to check both lamps. Then observe the relative brightness of lamps L1 and L2 while the lamp check switch is open. If L1 is the bright lamp, the phase sequence at the terminals of the indicator is 1-2-3; if L2 is the bright lamp, the sequence is then 3-2-1.

Suggested Phasing-Out Procedure

When energizing switchgear by connecting the first generator or incoming line, the phase sequence indicator is connected to a set of bus potential transformers as shown in Figs. 4 and 5. In Fig. 5, about 200 volts will be applied to the instrument. Hence it will be necessary to use the 220-volt terminals of commercial lamp type indicators, or add lamps or resistors to the indicator shown in Fig. 3. The solid line connections of Fig. 5 apply when three wye-wye connected potential transformers are used. The broken line connections apply when using two potential transformers connected in partial wye-wye.

After connecting the instrument, energize the bus from the first generator or incoming line and watch the phase sequence indicator. If the connections to the switchgear are correct, the sequence will show up as 1-2-3. Should the indicated sequence be 3-2-1, two of the three cable connections must be switched somewhere between the terminals of the source and those of the switchgear. After changing the cables, check the indicator again to be certain that the sequence has been corrected.

Should the cable connection shift be made within the zone of differential relay protection, make a corresponding change in the secondary circuits of current transformers serving the relays. Should the source circuit have synchronizing facilities, check the synchroscope by closing the synchronizing switch when the bus is energized from this source. If the synchroscope is in operating condition and the wiring is correct, the pointer will position itself at the "12 o'clock" or "zero degrees" mark.

If connections are being phased-out between a generator and switchgear which is energized by a previously connected source, the test procedure involves additional steps. Connect the generator to the switchgear in accordance with the intended bus phase sequence indicated on the switchgear drawings and the generator phase sequence indicated on the generator drawings. Connect the neutral current transformer secondary circuits for the differential relays to the proper terminal block in the switchgear in accordance with manufacturer's drawings.

Then carry out completely and rigidly the following step-by-step procedure:

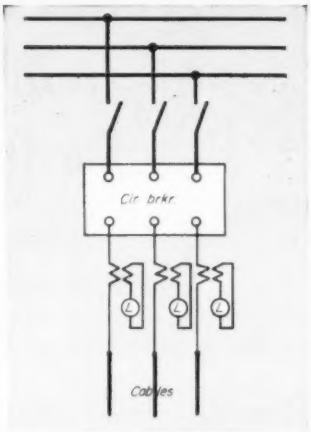


FIG. 1—Typical test scheme for matching phase sequence uses three spare potential transformers and three lamps. This test does not determine actual phase sequence.

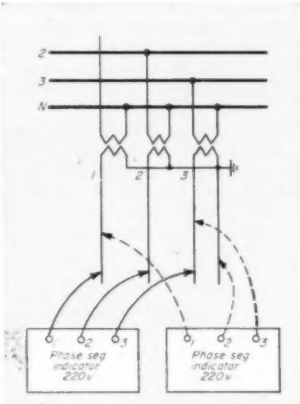


FIG. 5—Connections for phase sequence indicator on bus with three bus potential transformers connected wye-wye (solid line) and partial wye-wye (dotted line). Actual sequence is shown by instrument.

1. *Mark the generator cables at the generator* to show to which terminal (T1, T2, or T3) each cable is connected to. Disconnect the cables from the generator terminals. Securely brace these cables apart to prevent grounding or short-circuiting. In some cases, it may be easier to disconnect the neutral connections from generator terminals T4, T5 and T6, than to disconnect cables from T1, T2, and T3.

2. *Connect a phase sequence indicator* to the secondary terminals of the generator potential transformers. Fig-

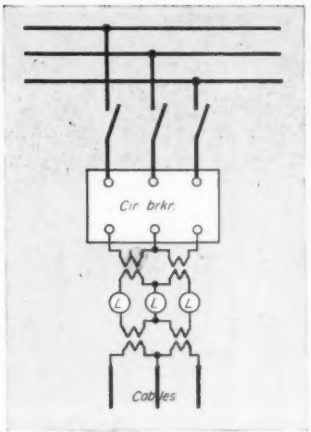


FIG. 2—Another method of phasing out switchgear uses four spare potential transformers and three lamps. This also merely matches sequence and gives no indication of existing phase sequence.

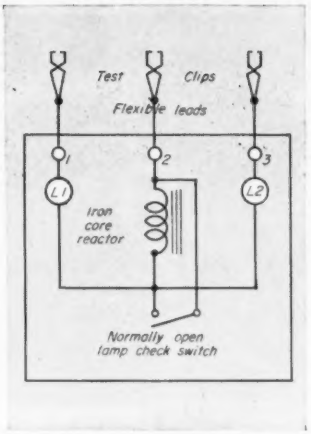


FIG. 3—Phase sequence indicator can be made from component parts listed if no commercial unit is available. This reactor-lamp type can be used on secondary circuits of potential transformers.

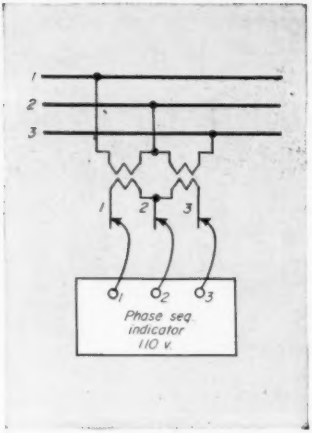


FIG. 4—Phasing out a bus using a phase sequence indicator connected to secondary circuit of set of two bus potential transformers connected into the circuit open delta-delta.

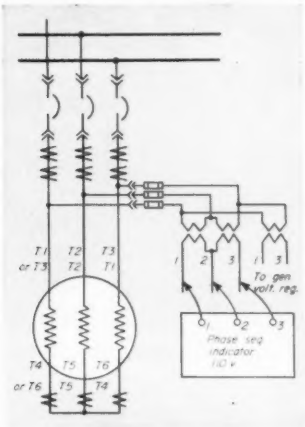


FIG. 6—Phasing out generator connections with phase sequence indicator connected to three generator potential transformers connected into the circuit open delta-delta.

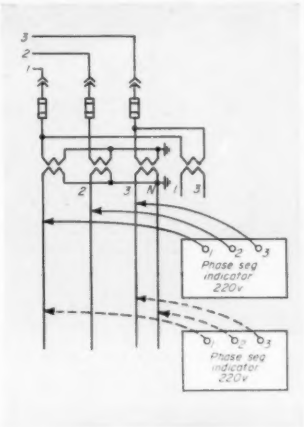


FIG. 7—Where generator potential transformers are connected wye-wye, phase sequence indicator is connected as shown by solid lines; where transformers are partial wye-wye, use dotted line scheme.

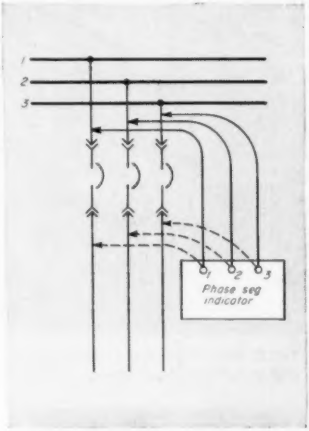


FIG. 8—To compare phase sequence at terminals of a low voltage circuit breaker, connect phase sequence indicator as shown first to bus terminal (solid lines) and then to source terminal (dotted lines).

ure 6 shows the connection for two transformers connected open delta-delta. Figure 7 applies where potential transformers are connected wye-wye (about 200 volts will be applied to the indicator and provision must be made for same). When the transformers are connected wye-wye, the solid line connections in Fig. 7 apply. When the transformers are connected partial wye-wye, the dotted line connections of this diagram apply. Once the phase sequence indicator has been connected, it should be left in the circuit until all tests have been completed.

3. *Rack the circuit breaker into normal position.* Close the breaker to put bus potential on the generator potential transformers and, hence, on the phase sequence indicator.

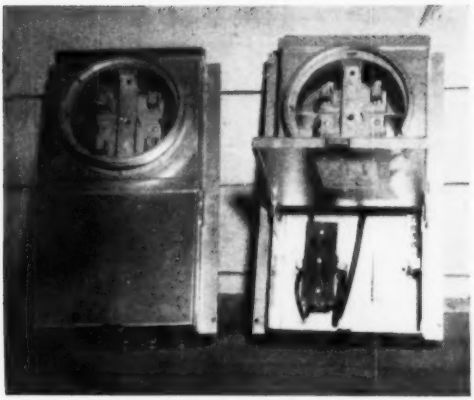
4. *Observe the indicator to determine phase sequence* on the bus. If the first generator or incoming line put on the bus was correctly phased out, the indicator will show a 1-2-3 sequence.

5. *Close the synchronizing switch to check* the synchroscope and the synchronizing wiring. If the scope is in operative condition and the wiring correct, the scope pointer will rest at the "12 o'clock" or "zero degrees" mark on the dial and the synchronizing lamps will be dark. If the pointer indication on the dial is incorrect, check and repair the scope and wiring before proceeding further. Leave the synchronizing switch on for only relatively short periods and turn it off when the synchroscope has been checked satisfactorily.

6. *Open the generator main circuit breaker* and lower same to disconnected position.

(*Continued on page* 152)

STACKED AND WAITING for installation is partial shipment of service cabinets which came to job as . . .

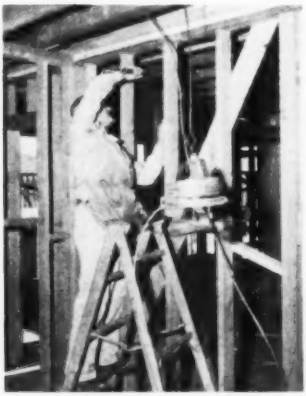


COMBINATION meter socket and load center in weatherproof enclosure. Unit is wired at factory.

FIELD SHOP assembly of brackets on ceiling outlets. Mechanic uses bench jig and automatic screw driver; ties boxes in bundles for delivery to houses.

TEMPORARY SERVICE posts provide outlets for power tools.

HOLE DRILLING CREW uses power-, operated, self-cleaning drills. After house has been completely "drilled," mechanics move on to next and in comes . . .



CABLE CREW to install non-metallic sheathed circuits. Payout bracket is suspended from rafter hook; can be moved from room to room.

SPLICING CREW is last in the house before walls are built. Mechanics use insulation strippers (no penknife) and crimp connectors; check circuits.

CONDUIT MAST and service conductors are added to cabinet in field shop assembly at rate of 50 units per man per day.

PRE-ASSEMBLED SERVICE takes only 10 minutes to install on frame of house.

DATA ON HOUSES

SIZE
2-Bedroom — 850 sq. ft.
3-Bedroom — 1050 sq. ft.

NUMBER OF OUTLETS
(Average, including garage)
Receptacles — 20
Switches — 15
Ceiling Fixtures — 10

BRANCH CIRCUITS
Receptacles — No. 12 non-metallic sheathed cable
Lighting — No. 14 non-metallic sheathed cable

SERVICE
3 No. 8 conductors in ¾-in. EMT.
Combination meter socket and load center cabinet with four 15- and 20-amp. circuit breakers and space for future 2-pole breaker for electric range. (Service size must be enlarged if range is added.)

Wiring 17,000 Houses

Efficient field organization, pre-assembly techniques and cost-cutting tools helped Kuster-Wetzel Electric Company keep pace with the mushrooming Lakewood Park housing project near Long Beach, California.

By August Eckel

FINISH WORK is speeded up by using one-piece molded plastic switches and plates and automatic screw driver. Minutes saved on outlets soon add up.

A few miles outside of Long Beach, California, is Lakewood Park—a 17,000 unit housing project being built by Aetna Construction Company and Biltmore Homes. Every day, more of these single-family, two and three-bedroom, frame homes are springing up on a 3,400-acre site—much of which formerly was bean patch. Within eight months 6,700 houses were up and 1,600 more scheduled to be started. Plans call for other 1,600-groups to be added until the project is completed. Such a pattern was designed to simplify manpower, warehousing and materials problems to a large extent.

While two general contractors are building the homes, one electrical contractor, Kuster-Wetzel Electric Company of Long Beach, is handling all the wiring. To meet the demanding time schedule on a project of this size, K-W leaned heavily on specialized field organization, judicious choice of material and generous use of labor-saving tools and methods. Just how they handled this gigantic project is outlined in the succeeding discussion and photographs.

Two installation groups, each composed of from 50 to 60 mechanics, were organized. Each group, with its own general foreman, operated out of a central field shop in each general contractor's specific "tract". Each group was further sub-divided into specialized crews to do the following:

1. Pre-assemble work in the field shop
2. Install service entrance
3. Spot outlets in the houses
4. Mount boxes
5. Drill holes for cable runs

(*Continued on page 78*)

How to Estimate Electrical Work—12

Units for installation of motors and controls

By W. T. Stuart

LABOR unit data shown in this article are for the more common motors and control hookups encountered on commercial and industrial work. For estimating purposes, the operation breaks down thus:

1. Installing and connecting motor.
2. Installing and connecting control.
3. Installing and connecting disconnect device.
4. Installing and connecting control operating devices.

The average installation will include two or more of the above parts as, for example, a ¼ horsepower motor with a manually operated switch which combines the disconnect and control function, or a 10 horsepower motor with a magnetic contactor, disconnect switch and several control stations.

By preparing labor units for each of these parts it is possible to cover a great variety of possible motor and control installations.

It will be noted that in these data, like other tables in this series, fastening time is not included in the unit. Some data on fastenings was given in the preceding article in this series. However, the variety of possible fastening, anchoring and supporting details and methods in motor and control installations requires individual job analysis and is not readily reduced to average units. Appropriate amounts should be added to the installation units to cover the fastening required.

Only one general type is covered in the motor installation table, the 3 phase, 60 cycle, 1200 rpm induction motor. For the estimator who wants to extend this data to cover other types of motors and controls with fair accuracy, the following can be used.

Select the motor nearest in electrical characteristics from the table.

Find the difference in weight.

Multiply the difference by .03.

Find the difference in connections.

For each additional

15 amp. connection add	.14
30 amp. connection add	.18
50 amp. connection add	.23
70 amp. connection add	.32
100 amp. connection add	.40

(each wire is a connection)

Add the totals to the original unit.

Example:

Find unit for 2 phase 15 hp. slow speed motor.

1. Select from motor table unit for 15 hp. 1200 rpm	16.00
2. Weight difference 300 lbs.	
3. 300 x .03	9.00
4. One additional 50 amp. connection (for 2 phases)	.23
5. Total unit	25.23

The same method of approximation can be used to add or deduct, however, this type of adjustment should not go beyond twice or below one-half of the base unit to which it is applied. If the resulting unit is beyond these extremes, another base unit nearer to the result should be tried.

14. MOTORS

Three phase induction 1200 rpm, 220 v.
Set on base, align, connect and test

Floor or low platform mounting	man hours each
Fractional hp	2.0
1 hp	3.5
2 hp	4.8
3 hp	5.6
5 hp	8.0
7½ hp	10.5
10 hp	14.0
15 hp	16.0
Mounting 6–14 feet above floor	
Fractional hp	4.0
1 hp	6.5
2 hp	8.0
3 hp	9.5
5 hp	12.0
7½ hp	16.0
10 hp	21.0
15 hp	24.0

Notes:

1. Units do not include the installation, anchoring or fastening of motor bases or supporting structures.
2. An approximate unit for motor base or support installation can be estimated at .05 m. h. per lb of base weight plus fastening time (see table 11, page 39, January Electrical Construction & Maintenance).

15. CONTROLLERS

15a Manual across-the-line starters 3 pole	man hours each
3 hp. or less	2.0
5 hp	2.8
7½ hp	3.1
10 hp	4.1
15 hp	5.5

15b Magnetic across-the-line starters 3 pole	
3 hp. or less	2.5
5 hp	3.3
7½ hp	3.6
10 hp	4.6
15 hp	6.0

15c 3 pole disconnect switch	
3 hp. or less	1.7
5 hp	2.5
7½ hp	2.7
10 hp	3.8
15 hp	5.2

15d Combination disconnect and magnetic starter	man hours
3 hp. or less	3.0
5 hp	3.8
7½ hp	4.1
10 hp	5.1
15 hp	6.5

15e Manually operated compensator starters	man hours
7½ hp	4.3
10 hp	5.3
15 hp	6.8

Notes:

1. Units do not include fastening to structure or supports. Time for setting anchors or supports must be added.
2. For reversing controllers add 50 percent to the appropriate manual or magnetic controller unit.

16. CONTROL DEVICES

	man hours
Stop button	.77 E
Start-stop button	.87 E
Start-stop-reverse	1.15 E
Start-stop-pilot	1.15 E
Start-stop-2 pilots	1.29 E
Manual-automatic-off	1.15 E
Thermostat	.87 E
Any remote automatic device connect only 2 wire	.42 E
connect only 3 wire	.56 E

Notes:

1. Units except as noted cover installation and connections. No fastenings are included; shields, drilling and tapping, etc., must be added.

Help Yourself to Lower Taxes

Tax pointers for contractors prepared with cooperation of American Institute of Accountants.

By Roy Kammerman
The Stephen Fitzgerald Company
New York, N. Y.

YOU may be paying higher taxes than you need to.

Everybody is going to have a heavier tax burden as a result of our national defense requirements. But the government wants taxpayers to pay only their *fair* share. It doesn't want you to overpay, any more than you yourself do.

Hundreds of business men are discovering that by advance planning and sound accounting they can reduce their tax liabilities.

Take the case of electrical contractor Bill Jones.

Jones needed a new, heavy-duty truck. He had taken annual depreciation on his old truck and its depreciated value on his books was now $1800. The truck had seen hard service, however, and the best trade-in allowance Jones could get was $1,000.

Jones considered the tax effects of the deal and decided to make two separate transactions. He *sold* the old truck for $1,000. Then he bought the new truck.

By *selling* the old truck, Jones suffered a book loss of $800—the difference between what he sold it for and its depreciated value. He was permitted to deduct that loss from his taxable income because he had *sold* the truck. If he had traded in the truck, he would *not* have been allowed to claim the loss. For tax purposes, ***no gain or loss is considered to result from a trade-in.***

If Jones had been offered, say $800 more than the book value of the truck, he perhaps would have been better off to *trade in* the truck since the $800 would then *not be taxable.*

Alertness Pays

There are many opportunities like this where a transaction in one form may be taxed higher than a deal which accomplishes the same purpose in a slightly different manner. It will pay you to be alert to such opportunities. The time and form of a deal as it affects your taxes may sometimes be more important than dickering for a more favorable price.

Tax economy is possible, however, only through good accounting and—when legal problems are involved—through consultation with an attorney. You will find that your certified public accountant is the man best able to help you with the accounting problems. He has passed difficult State examinations, and has satisfied State officials that he has the education, experience and skill necessary to help you. If you cultivate the habit of asking his advice on accounting problems, substantial tax savings can result.

The following cases are examples of how advance planning can minimize taxes. *These cases, of course, cannot serve as a substitute for professional advice on your particular problems, since even a slight, apparently unimportant variation might completely alter your tax status.*

Fire Insurance Proceeds

If you suffer a casualty loss, always seek professional tax advice.

(*Continued on page* 148)

1. Service calls come into dispatcher's office over six trunk lines at the rate of 20 an hour; are immediately processed for scheduling.

2. New orders are entered in plan book for assignment to truck crews. Jobs are grouped and scheduled according to geographical location to reduce "running" time.

OPERATION "SERVICE"

Central dispatching office coordinates and controls service operations, boosts overall efficiency at Sturgeon Electric Company, Inc., in Denver.

SERVICE is a prime function of an electrical contractor. Just how well he can satisfy the customers' demands within reasonable time limits may determine whether the future will bring in repeat orders—or competitors.

This is especially true where the electrical contractor engages in a "general practice" involving all types of electrical work in contrast to specialization in a specific branch. A reasonable return on so-called "small" service work frequently hinges on volume and the ability to efficiently handle jobs of this type.

Sturgeon Electric Company in Denver makes this type of work pay off. Its formula: increased volume through service; reduced overhead through efficient organization. Ralph E. Johnson, vice-president and general manager of the firm, had this in mind when he set up a central dispatching office to coordinate and control service orders.

According to Sturgeon's definition, a service order is one requiring up to eight hours of a mechanic's time. All requests of this type are directed to the central dispatcher's office conveniently located between the general office area and stock room. Calls come in on six telephone trunk lines at the daily rate of 20 per hour. These are immediately processed and turned over to chief dispatcher Harold E. Clark who enters them in a plan book for assignment the following day.

Under Clark's supervision are ten journeymen, each operating a fully equipped truck. Normally, these mechanics pick up their following day's assignments when they report to the shop at the end of each day to fill out completed order forms. Last minute assignments are dispatched at 8:00 am each morning. If a truck completes its rounds earlier than expected, the mechanic calls the office and is given a fill-in job in his operations area.

Clark can tell at a glance where his men are and what they are doing. Mounted on the wall above his desk is a hinged Service Order Board consisting of five sheet metal panels mounted on angle-iron frame. Each panel has 12 spaces or "slides" in which 2-in. by 4-in. order cards can be placed. Each card contains pertinent information of work order number, date, address, type of work, wireman's name and date

DATE ____ W. O. No. ____

JOB ____

ADDRESS ____

WORK ____

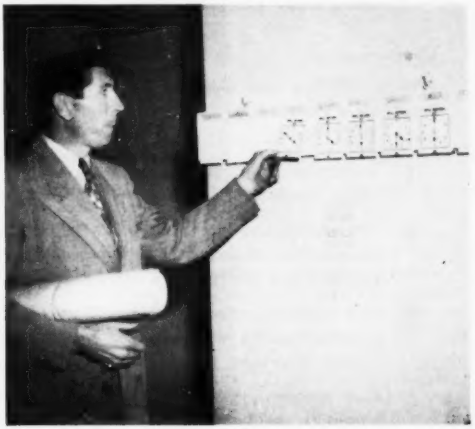
WIREMAN ____ DATE PROMISED ____

JOB CARDS like this are posted on control boards—white for service calls, yellow for construction projects.

3. Jobs are posted on Service Order Board under name of each journeyman operating a truck. Those on top are current; remainder are future assignments.

4. Manpower control board for the construction division lists mechanics on each project; gives up-to-the-minute picture of manpower allotment and job progress.

5. Radio-telephone in construction superintendent's truck permits him to contact office and issue instructions while driving between jobs.



6. Engineers on call post "time of return" on plastic card clocks under their names. Reversed blank card means man is in office.

promised. The board has a total of 10 columns. In the top space of each is a card with a journeyman's name printed in large letters. Directly under the name card are work order cards indicating the jobs that particular mechanic is now doing. Below these are his assignments for succeeding days. As completed job cards are removed, the other cards are progressively moved up and new ones added to the bottom of the column. Completed work orders are processed and priced in this office.

A similar manpower control scheme is used by the construction superintendent, Clarence Trichka. Although operated as a separate department, his headquarters are in the same office. On his control board, top cards are yellow job cards listing name and location of the construction project together with other pertinent data. Adjacent to and directly under this project identification are white name cards listing each journeyman on that specific construction job. As men are moved from project to project, these name cards are shuffled on the board accordingly. Thus, Trichka always has a visual indication of allotted manpower and job progress.

Also adding to the efficiency of his operation is the radio-telephone in his truck. As he makes his rounds of projects anywhere within a 75 mile radius of his office, he can call in en-route to order materials or men.

Should a customer want the services of an engineer, the telephone operator can tell in a second if the man is in or out and when he will return. All she need do is glance at the "in and out" board mounted in the general office. Under names of all engineers are small plastic clock cards. When a man goes out, he sets the hands of the clock to the time he will return and places it on the peg under his name.

Viewed from an over-all standpoint, this combination of ideas and methods has given manager Johnson what he has been seeking—better service to the customer and increased efficiency.

Detroit's Reciprocal Licensing Program

How reciprocal agreements solved the multiple-licensing problem of Detroit area electrical contractors and lead to uniform municipal examination and code requirements.

CONTRACTOR REQUIREMENTS

Under Reciprocal Licensing Program

Eligibility

1. Applicant must have held a journeyman electrician's license in one of the reciprocating communities for a period of two years.
2. Applicant's place of business must be located in the municipality where he applies for license.

Examination

Upon fulfilling the elegibility requirements, the applicant must pass a standardized four-part written examination consisting of the following:

1. Twenty questions on fundamentals and theory of electricity. Applicant can answer any ten questions.
2. Ten questions on interpretation of the National Electrical Code and Local Regulations. Applicant must answer ten questions and can refer to Code during this part of exam.
3. *One problem on practical layout of wiring and power systems* involving size of feeder and service conductors, number of circuits, size of conduits and other design data.
4. *One problem on estimating quantities of labor and materials and pricing same* using estimating units furnished with the examination.

LICENSES ISSUED

Under Reciprocal Licensing Program

The following is a partial list of licenses and registrations issued by a portion of the reciprocating municipalities operating under the program:

Municipality	*Contractors*	*Journeymen*	*Registration*
Allen Park	100	125	250
Clinton	15	50	100
Detroit	800	4,000	350
Ferndale	50	100	200
Grosse Pte. Farms	100	100	500
Highland Park	50	140	300
Melvindale	25	35	200
Pontiac	50	200	100
River Rouge	150	100	150
Royal Oak City	100	300	500

MULTIPLE-LICENSING is familiar to all contractors who have had occasion to operate outside of their respective communities. A common procedure is for individual municipalities and cities to require "outside" contractors to pass an examination and pay an annual license fee to work within the municipal limits, even for a single job. Thus, a contractor operating in a dozen areas around his home grounds would have to take as many examinations and pay license fees which might total $300 or more annually. Although this practice is distasteful to the contractor, it is generally considered a "necessary evil" which cannot be helped.

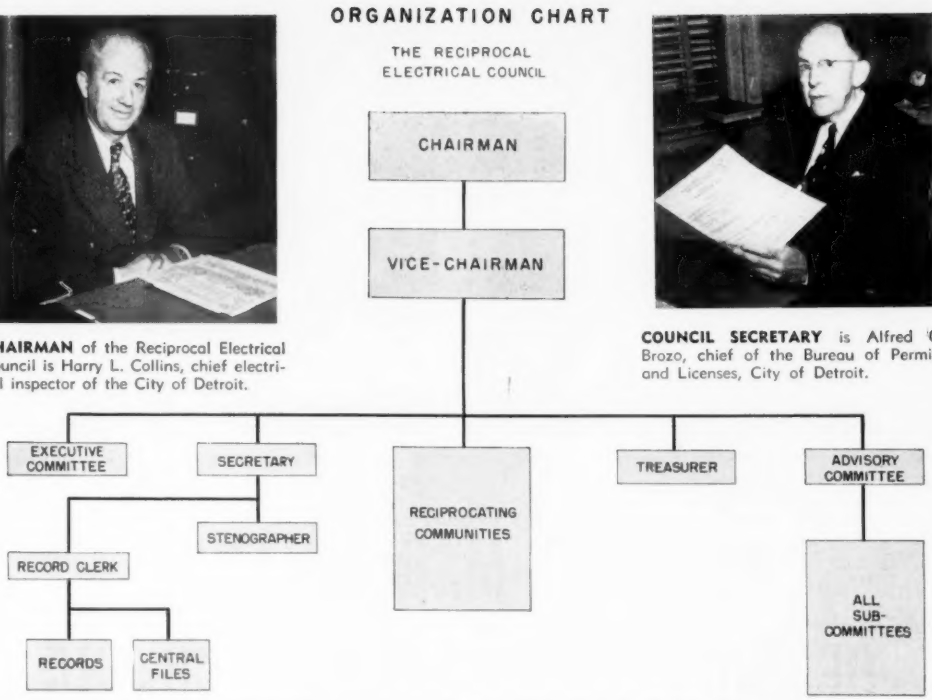
How It Started

Indifference to this problem was not the rule in the Detroit area. As far back as November, 1939—after the Michigan State Licensing Law was declared unconstitutional—Detroit's electrical industry got into a huddle and came up with a reciprocal licensing program which they hoped would eliminate the inherent disadvantages of multiple-licensing. At that time, the City of Detroit passed an ordinance permitting electrical contractors "lawfully licensed by other municipalities of the State of Michigan" to work within the city limits upon payment of a nominal one-dollar registration fee. Such permission was granted only if those municipalities reciprocated by permitting Detroit contractors the same privileges; charged the same uniform license and registration fees; and had licensing ordinances substantially equal to the Detroit ordinance. Journeyman electricians licensed by cooperating municipalities could work in Detroit without payment of an extra registration fee.

Within six months, 27 municipalities around Detroit had passed ordinances incorporating the reciprocal features. Today there are 48 municipalities (including Detroit), 2,700 electrical contractors and 8,000 journeyman electricians operating under the program. Each year, approximately 7,000 registration certificates are issued by the

CHAIRMAN of the Reciprocal Electrical Council is Harry L. Collins, chief electrical inspector of the City of Detroit.

COUNCIL SECRETARY is Alfred C. Brozo, chief of the Bureau of Permits and Licenses, City of Detroit.



ORGANIZATION CHART of the Reciprocal Electrical Council, administrative body for the Detroit reciprocal licensing program.

cooperating communities. What started as a temporary expedient, pending a revised State licensing law, has become a permanent program. In fact, proponents of a new State law now are exploring the possibilities of expanding the reciprocal plan on a statewide, self-policing, self-supporting basis.

How The Plan Works

Administration of the program is vested in The Reciprocal Electrical Council organized in January of 1940. Headquartered at Detroit's electrical inspection bureau (because of available facilities), the Council consists of a chairman, vice-chairman, secretary, treasurer, executive committee and advisory committee. All officers, except the treasurer, must be members of an electrical inspection department. Serving on the executive committee are chief electrical inspectors elected by the reciprocating municipalities. Advisory committee members represent industry groups (electric association, contractors, utilities, IBEW, inspectors, etc.) who sponsor and financially support the program. This nine-man committee guides policy making, listens to grievances, discusses problems, but has no vote.

The Council secretary is responsible for the mechanics of operation. He supervises maintenance of the Central Files containing records of the 10,700 electrical contractors and journeymen working under the program. Each record is a complete case history of the applicant—his examination grades, application forms, license issue, registration issue and other pertinent information. Such a ready reference practically precludes "slick" operators from working illegally within the geographical confines of the reciprocal program. A telephone call to headquarters will quickly uncover his complete past history.

The Council has set up a total of seven Central Examining Boards in the reciprocating municipalities. Applicants in communities without an examining board can go to one of these central points. Each Central Board is comprised of the Local Board of a municipality having suitable facilities for examination together with at least one representative of the applicant's local board. A typical examining board consists of one representative from each of the following industry groups; public utility; electrical workers union; electrical contractors association; industrial electrical engineers (plant electrical departments); and public lighting commission. Each board member is recommended by his respective industry group and is appointed by the Mayor of the municipality in which the board operates. Members remain in office until removed for just cause.

Standardized examinations are used by all boards. Papers are graded by the Central Board and a recommendation returned to the applicant's local board. A copy is sent to the Central File for recording.

Before an applicant can take an examination, a copy of his application is sent to the Central Files of the Council for checking and a report on his eligibility. Once the applicant passes the examination and is approved, he is issued a certificate and identification card. Both documents bear a number assigned to the municipality in which his place of business is located. Reciprocal registration cards bear the assigned number of the community issu-

(*Continued on page* 151)

RELIGHTING in this area uses 4/40-watt fluorescent luminaires on 12½-foot centers to provide 45 footcandles of well diffused illumination maintained.

CLEANING TANK has two compartments, one for detergent solution, other for clean water. Immersion heater units maintain desirable temperature.

PLANNED MAINTENANCE OF INDUSTRIAL PLANT LIGHTING

A 15-year program of lighting maintenance in the Westinghouse Pittsburgh plants has resulted in increased illumination and adoption of many practical maintenance techniques. Many types of lighting equipment are involved.

By R. G. Edsall
Works Electrical Engineer
Westinghouse Electric Corporation
East Pittsburgh, Penna.

TODAY man lives and works largely indoors. This represents an environmental change which inadvertently affects the human eye. The eye has evolved through countless ages, doing its work almost entirely out of doors, in bright daylight, and for simple, long range seeing. Now, it does its work indoors, mostly under artificial illumination, and for long hours at close tasks involving constant accommodation. Too often artificial lighting is inadequate, causing eye strain and unnecessary bodily fatigue.

Good artificial lighting improves the conditions under which eyes must work indoors, and relieves eye strain resulting from the performance of the many difficult close range visual tasks. For this reason artificial lighting installations are designed to meet specific environmental conditions and varying visual tasks.

Design levels of illumination are based on reasonable maintenance of the lighting system. So long as the lamps are replaced as they burn out, and so long as the reflectors and diffusers are kept clean and bright, the design levels will be realized. But, if burned out lamps are not replaced, and reflectors and diffusers are not kept clean, the lighting efficiency will be seriously impaired.

In the Pittsburgh Westinghouse plants, former practice was to clean all luminaires and re-lamp at least once every four months. This practice was followed up to the depression years of the early 1930's. It was then dropped during the depression years, since Westinghouse, like everyone else, did not have the finances to carry out this work.

In 1936 a survey revealed that lighting levels in these plants were decreased 65 percent, due to lack of maintenance. Analysis of the lighting systems in use indicated that the cost for cleaning and maintaining would be far less than the cost of the power being lost due to lack of maintenance. Also, it was indicated that the illumination could be restored almost to original design levels and maintained at this constant level through good maintenance. Thus a rigid maintenance schedule was planned and adopted, in order that maintenance would not be a hit or miss proposition, and so that the benefits of the total lighting power load would be realized.

The total area involved in the present planned lighting maintenance program in the Pittsburgh Westinghouse plants is in the order of five

million square feet. This total area is subdivided into five plant divisions, for accounting purposes.

In planning the maintenance for all five divisions, the area in each was divided into separate sections. A schedule of cleaning and maintenance was then planned for each section, on a four-month period basis, so that each section is completely maintained three times a year. The periods for cleaning the various sections were staggered, so that during a four-month period each section occurs on the schedule once. During each cleaning period for a section, the luminaires are thoroughly cleaned and all burned-out lamps are replaced. Therefore, at least three times a year all luminaires in each section are in perfect condition and the lighting levels are at design standards.

Broad Program

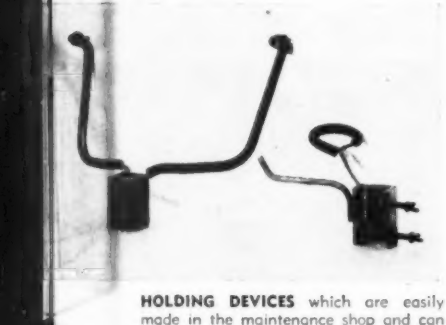
A wide range of types of lighting systems, luminaires, and light sources are involved in this maintenance program. Practically all office lighting is fluorescent, using ceiling mounted luminaires. These luminaires are of the four 40-watt lamp type, with egg-crate louver shielding. Production areas vary in physical characteristics, and include low bay areas with ceiling heights of up to 15 feet, medium bay areas with ceiling heights averaging 25 feet, and high bay areas with ceiling heights of 42 feet or more.

Low bay areas are lighted with either fluorescent or incandescent luminaires. In the offices and low bay plant areas, the luminaires are usually serviced from stepladders. The medium bay areas are usually lighted with incandescent or mercury vapor luminaires, or combination incandescent-mercury vapor units. Most of these luminaires are reached from extension ladders, or in some instances from the top of the bridge cranes. In high bay areas incandescent luminaires, or incandescent and mercury vapor units provide the lighting. These luminaires are installed in such a manner that they can be serviced from the catwalk of the overhead bridge cranes. In some instances the clearance between the catwalk on the crane and the roof truss is so great that permanent platforms are mounted on the crane trolleys. All high bay luminaires are equipped with safe-change hangers so that an entire unit can be removed for maintenance. These units are lowered

TWIN MERCURY-INCANDESCENT units, 400-watt mercury and 750-watt incandescent, provides 45 footcandles in a typical manufacturing and assembly area.

NEW MERCURY UNIT using 1000-watt mercury lamp was used to light large generator manufacturing aisle, with 1500-watt incandescent units between trusses for color correction. Maintained illumination is over 45 footcandles.

EXTENSION LADDERS and stepladders are satisfactory for servicing lighting units on the spot for mounting heights up to about 16 feet.



HOLDING DEVICES which are easily made in the maintenance shop and can be attached to any type of ladder, can be used to hold fixture parts on ladder within easy reach of maintenance man.

to the floor where cleaning is done, and if necessary new lamps are added as required.

Maintenance of incandescent and mercury vapor luminaires is a fairly simple job. The units are washed, and burned-out or badly blackened lamps are replaced.

Maintenance of proper voltage is an important factor, to be watched with all types of light sources. But it is particularly important on incandescent lamps. As a rule, incandescent lamps should be burned at their rated voltage. Over-voltage operation will result in higher wattage, higher efficiency and higher light output. But it also shortens lamp life materially. Under-voltage burning causes a reduction in wattage, in efficiency, and in light output, while increasing the lamp life. A voltage drop of as little as five percent below normal results in a loss of light amounting to more than 16 percent. This same drop in voltage provides a saving in wattage of only eight percent. Since lamp cost is always small in comparison with the cost of power to operate the lamp, the increased lamp life which accompanies reduced voltage does not begin to compensate economically for the loss in light output.

The voltage applied to fluorescent luminaires should be kept well within the operating range of the ballasts. For normal supply voltages, this range is from 110 to 125 volts, or 118 volts average. Low voltage as well as high voltage reduces efficiency and shortens lamp life. Low voltage may also cause instability in the arc, while over-voltage results in excessive operating current and may over-heat the ballast, and cause lamp failure.

Rated Lamp Life

The life of a fluorescent lamp is affected not only by the voltage and current supplied to it, but also by the number of times it is started. Electron emission material is "sputtered" off from the electrodes continuously during the operation of the lamp, and in particularly large quantities each time the lamp starts. The normal end of life is reached when the emission material from either of the two electrodes is used up. Therefore, the greater the number of burning hours per start, the longer the life of the lamp will be. For example, rated average life of a 100-watt T-17 60 inch lamp is 2500 hours when operated three hours per start, 4500 hours at six hours per start, and 6500 hours at twelve hours per start.

Maintenance of fluorescent lighting systems, particularly in office areas where units are ceiling mounted, is usually performed by a team of two to four men equipped with the necessary ladders and cleaning tanks. One man on the ladder removes the lamps and reflectors or louvers, and passes them to the men on the floor for cleaning. Lamps are wiped with a wet cloth, while louvers are dipped in a long tank containing water and a soapless powder detergent, after which they are put back in the luminaire while still wet. Reflectors are washed and dried, and then reinstalled.

Until recently, it took about 15 minutes for a maintenance crew to properly clean a single four-lamp louver type luminaire. The major portion of this time was spent in cleaning the egg crate louver. Many different detergents were tried, in an effort to find something which would reduce this cleaning time, but with little or no success. Then a substance called Alcono, used successfully for cleaning chemical glassware, was recommended. A shallow 40-gallon tank was constructed, and Alcono was added to the tank of water in accordance with the directions on the box. This worked fine. The louver was slushed in the solution for one-half minute, removed, excess water was shaken off, and the louver reinstalled while it was still wet. Cleaning time was cut from 15 to two minutes per luminaire. An aftermath of the first cleaning with Alcono was that two weeks later the louvers changed color to a dirty brown—a result of too strong a solution. Through experiment, a ratio of one pound of Alcono to 40 gallons of water was finally selected as proper for cleaning louvers. Cleaning time is now five minutes per luminaire as compared with the previous time of 15 minutes. The savings involved are well worth the time spent on planning such maintenance. In one building alone, containing 2650 luminaires, cleaning time for one crew was reduced from 660 to 220 hours.

Two major problems exist in the maintenance of fluorescent lighting systems, which can be solved easily. First, is the problem of "flickering" in the tubes. This trouble is two-fold: 1) it disturbs employees; 2) it creates a problem of burning out the ballast, due to heating the ballast with the excessive current which exists in a ballast when it is trying to "start" a lamp. This "flickering" can be entirely eliminated by using no-blink starters, which automatically cut off the offending lamp if the current is excessive for any reason.

The second major problem relates to plastic louvers. When plastic louver luminaires are first installed, all goes well until the first cleaning. During this first cleaning, if soap and water is used and the louvers are dried with a cloth, the louvers will be as dirty after about two weeks as they should be after four months. Reason is that drying of the louvers loads them with static electricity which causes dirt to be attracted to the surfaces. Solution to this problem is to use a soapless powder solution—Dreft is used by Westinghouse—then rinse in a clean water bath and reinstall the louvers while still wet.

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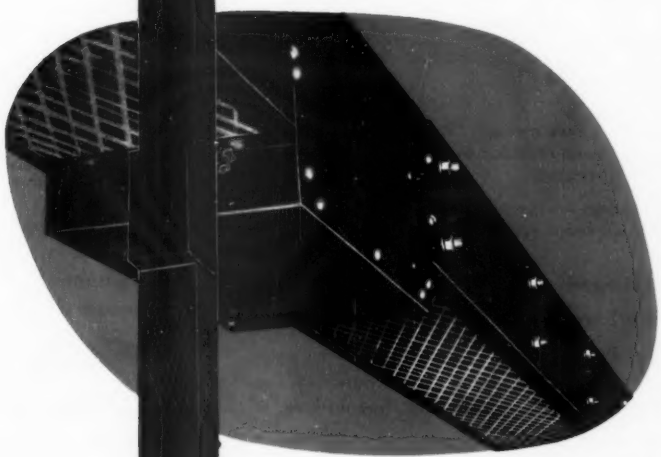

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"About May of 1947 we replaced the fuses with 400 ampere Fusetron fuses. Since then we have not had the circuit down once because of a needless blow."

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May cost you more than replacing every ordinary fuse with a FUSETRON dual-element fuse.

But, simply knowing that FUSETRON fuses do save money is knowledge — but it isn't action.

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Their cost is surprisingly low.

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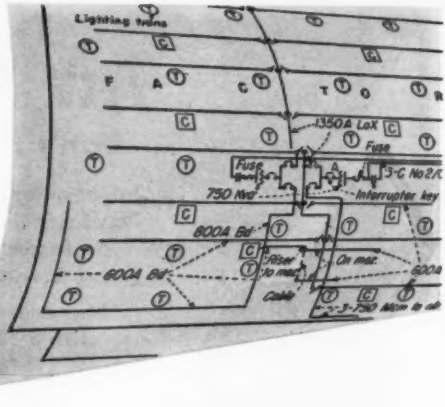

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Practical Methods

ADEQUATE SPACE to spread out plans is feature of this long take-off counter in the estimating room of the H. P. Foley Company's new headquarters in Salt Lake City, Utah. Dual counter runs almost full length of room, has tilted work surface at convenient height for either standing or sitting (on stool) positions. Central shelf accommodates estimating forms, specification books, intercom unit. High intensity fluorescent lighting is provided for estimators and draftsmen working in the area.

Grounds Traced on Live AC and DC Lines

MAINTENANCE

In plants where continuous operation prevents the chasing of accidental grounds during periodic shutdowns, methods for locating grounds while equipment is in service are of definite assistance to plant maintenance engineers. This is emphasized by W. E. Beneze of Alton, Illinois, for his plant works around the clock for a full 365 days each year. Faced with the necessity of locating grounds on live circuits, several techniques were developed for trouble-shooting on both ac and dc circuits.

On their 440-volt 3-phase ungrounded system, grounds are traced by applying a resistance load of 10 or 15 amperes to the circuit through a contactor in a timed signal. The timed signal is followed with a split core ammeter of the conventional type. The same procedure is followed on dc lines, using an ac source from a small transformer. The timed signal is traced with an ac split core ammeter which is not sensitive to dc. The small transformer delivers 15 amps, 60 cycles, between 50 and 60 volts.

Grounds can also be traced by using a 3-phase synchronous motor running at no load, with one leg taking power through the accidental ground. Opening and closing of the dc excitation circuit permits the motor to run synchronous, then squirrel cage, with no dc on the field. The change in frequency from 60 cycles to the lower frequency, due to a drop in speed from 1200 rpm to 1160 and back to 1200, can be traced readily to the point of ground by using a timed signal, an exploring coil and head set.

The exploring coil used by W. E. Beneze was an ordinary 440-volt holding coil with no core. Receivers were 1000-ohm double-phone. The starting point was the point at which the motor was connected. The regular 60-cycle hum remains constant while the lower frequency rises and falls as dc is applied and removed from fields in the timed signal.

Costs Reduced in Handling Materials

MANUFACTURING

In many manufacturing plants, nonproductive operations are forcing break-even points to all-time high levels, for moving parts and partially-assembled products necessitate costly interplant handling, storage, receiving and shipping operations. More and more thought is being devoted, therefore, to equipment which will reduce the time and labor associated with handling materials.

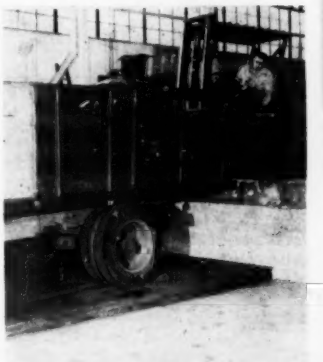
An interesting indication of the manner in which modern management is reducing these overhead charges is found in the new plant of the Reliance Electric and Engineering Company at Astabula, Ohio.

Approximately 2600 lineal feet of roller conveyors connect work stations; a fleet of three electric and one gasoline-powered elevating fork trucks are in use for service in the multi-tiered storage area; seven electric and 10 hand-powered pallet trucks are in use, and over 2800 pallets and skids are employed as tools to achieve profitable production.

An overhead monorail conveyor system forms an integral part of the Reliance dc coil dipping-and-baking operation—one track section being raised and lowered by means of an electric hoist to dip coils suspended from racks as the coils pass the tank of insulating varnish.

The high-bay central section of the plant is served by three 54-foot 3- and 5-ton travelling cranes, and individual machines and work stations are separately served by jib cranes and electric-powered hoists. At no point throughout the manufacturing cycle is heavy lifting required of workers.

Worthy of special note is an unusual feature in both receiving and



PUSHBUTTON CONTROL and hydraulic operation of truck dock lifts, installed in both receiving and shipping departments of the Reliance Electric and Engineering Company's new plant, permits palletizing of products and the use of motorized industrial trucks for fast materials handling.

EVER-LOK
RECEPTACLES, PLUGS & CORD CONNECTORS

For Heavy Duty Industrial Use and Many Other High Cycle Jobs

Here is a new EVER-LOK 30 ampere, 440 volts, A.C., capacity unit for heavy duty and high cycle applications. Many advanced features, combined with sturdy, precision-built construction make this EVER-LOK a most versatile and dependable unit for quick, safe connections to high cycle tools and large portable equipment.

Automatic Locking Plug prevents faulty contacts and accidental separation. Plugs and Cord Connectors are built tough and husky to withstand the severe use encountered in heavy duty service. Designed for easy, convenient wiring connections, and quick accessibility.

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30 Amperes
440 Volts,
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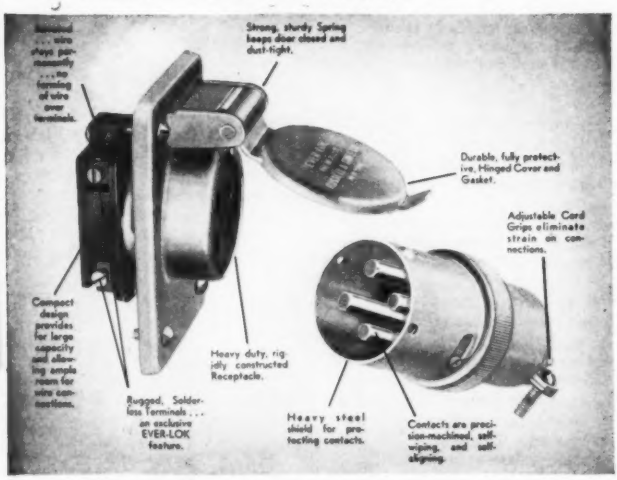
Strong, sturdy Spring keeps door closed and dust-tight.
Durable, fully protective, Hinged Cover and Gasket.
Adjustable Cord Grips eliminate strain on connections.
Compact design provides for large capacity and allowing ample room for wire connections.
Heavy duty, rigidly constructed Receptacle.
Rugged, Solderless Terminals . . . an exclusive EVER-LOK feature.
Heavy steel shield for protecting contacts.
Contacts are precision-machined, self-wiping, and self-aligning.

New Bulletin EL446-4 gives all the facts about the EVER-LOK 30 ampere unit, lists ordering information and other pertinent data. Write for copy.

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shipping areas that further expedites unloading and loading of trucks. Two hydraulically-operated, pushbutton-controlled dock lifts, designed and developed by Reliance engineers, permit adjusting any truck bed through an 18-inch range to the level of the shipping and receiving dock floor. Each lift is 10- by 15-feet and will handle axle loads up to 15,000 pounds. Thanks to the quick, convenient access to floors of trucks and trailers resulting from the installation of these lifts, large unit loads can be readily palletized and handled with the plant transport equipment.

All shipping is protected from the weather by enclosed loading docks. For trucks, the dock measures 80 feet in length, 40 feet in width and 18 feet in height, readily accommodating at one time three of the longest trailer-tractor combinations in general highway use today.

The railroad dock measures 130- by 20-feet, accommodating two railway cars at one time. Like the truck dock, the roadbed is depressed in a concrete pit, putting the deck of a gondola, flat or box car at the same level as the plant floor.

So profitable has rapid materials-handling proved that Reliance considers these facilities an unusually sound investment. In their effort to adopt modern methods for improving this non-productive phase of manufacturing, they have discovered that these provisions are a major factor in realizing higher productivity at reduced unit costs.

Battery Maintenance Depends on Instruments

MAINTENANCE

Two of the most important instruments in a battery room are the hydrometer and thermometer, for they indicate the state of charge of the battery and whether it is in condition to perform satisfactory service. Care of these instruments is important but simple, requiring only that they be wiped dry and returned to their assigned places after use, kept clean to prevent foreign particles entering the battery and, occasionally, taken apart (hydrometer), cleaned and examined for defects.

Correct use is as important as proper maintenance. For example; when using the hydrometer, the rubber nozzle is placed into the battery vent opening and enough electrolyte drawn into the barrel to permit the indicating float to ride freely without touching the barrel at any point. Readings should be made with the eye level with the electrolyte mark. If the hydrometer must be re-

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Indicating trim clamps which speed the trim installation.

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HYDROMETER and thermometer are important to battery maintenance and should be used and maintained properly in accordance with instructions of the Gould Storage Battery Corporation.

moved from the vent for reading, the nozzle should be pinched or closed with a gloved finger to prevent dripping of the electrolyte.

Specific gravity corrections are made on the basis of 3 points (plus or minus) for every 10 degrees F of electrolyte temperature, with 77 degrees F used as a base. This correction is necessary to obtain accurate specific gravity readings. As the temperature of the acid rises, the acid becomes less dense and expands. Because of the decreased density, the float rides lower than normal, giving readings that are low. Conversely, when the acid is cold, the float rides high and the corresponding reading is high. Thus:

Hydrometer Reading	Thermometer Reading	Correction	True Sp. Gr.
1.250	87F	3 plus	1.253
1.210	80F	1 plus	1.211
1.180	64F	4 minus	1.176

Some thermometers specially scaled for battery application permit direct gravity corrections. These thermometers have a second column of figures adjacent to the regular temperature scale, preceded by a plus sign above 77 degrees F and a minus sign below. Reading the figures at the mercury level ascertains the amount of correction necessary. So, if the hydrometer reading is 1.260 and the second scale on the thermometer reads plus 8, the true specific gravity is 1.268—the sum of the two figures.

Unpacking a new hydrometer calls for a check of rubber bulb, glass barrel, rubber nozzle and float. Breaks and cracks should be noted and dirt and packing material should be washed away to prevent it getting into the electrolyte. Then, wearing gloves in the event of possible breakage, rubber nozzle, rubber bulb and glass barrel are lubricated with plenty of water, and assembled.

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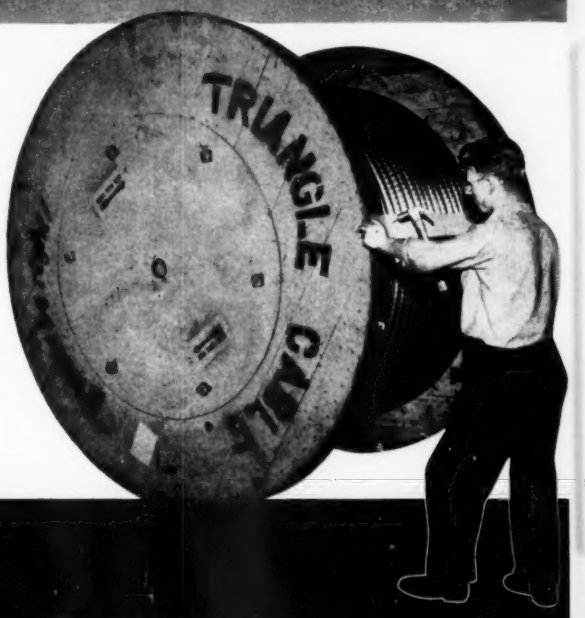

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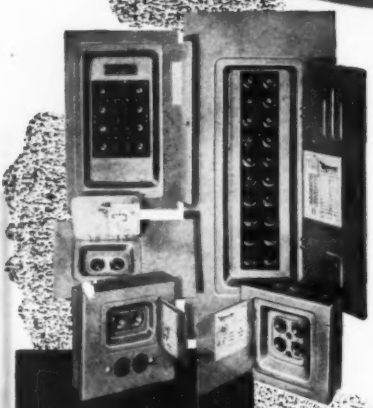

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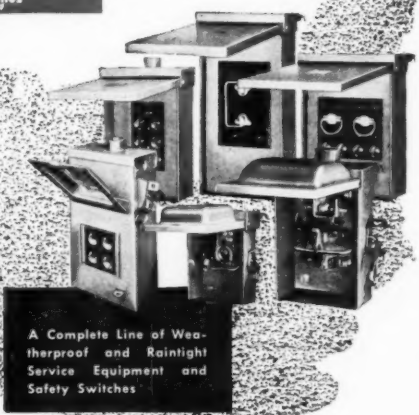

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Type A Enclosed Safety Switches . . . . . ☐

H.P. rated. 30 to 1200 amps., 230V through 600V. Fusible and non-fusible (with or without neutral) for 2, 3, 4 and 5 poles. Positive switching mechanism — quick-make and quick-break. Interlocking cover.

Type C Enclosed Safety Switches . . . . . ☐

H.P. rated. 30 to 600 amps., 230V through 600V. Fusible and non-fusible (with or without neutral) for 2, 3, 4 and 5 poles. Positive switching mechanism — quick-make and quick-break.

- *Abundant knockouts—ample wiring space*
- *Dependable open knife-blade construction.*
- *Solderless pressure wire connectors.*

Type D Enclosed Safety Switches

For Cartridge Fuses . . . . . ☐

H.P. rated. 30 to 600 amps., 230V-250V. Fusible and non-fusible (with or without neutral) for 2, 3, 4 and 5 poles. Spring actuated quick-break.

For Plug Fuses

Front Operated Toggle . . . . . ☐

H.P. rated. 125V-250V. Fusible and non-fusible (with or without neutral) for 2 and 3 poles. Snap-action, toggle actuated. Dependable, full-floating contacts. With or without dead front plate.

Side-operated. *Knife blade switch construction. Spring actuated quick-break.* **Front operated** *— snap-action toggle.*

Side Operated . . . . . ☐

H.P. rated. 125V-250V. Fusible and non-fusible (with or without neutral) for 2, 3 and 4 poles.

Rust resistant steel enclosures.

Raintight Enclosed Safety Switches . . . . . ☐

H.P. rated. 30 amps. (plug or cartridge) to 200 amps. Fusible, and non-fusible (with or without neutral) for 2, 3 and 4 poles.

Double Throw Enclosed Safety Switches . . . . . ☐

30 to 600 amps. 230V through 600V. Fusible and non-fusible for 2, 3 and 4 poles.

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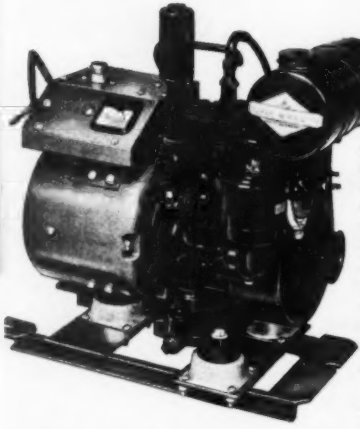

On the battlefield and in the field of industry where time, money and life depend on steady electric power, CYCLOHM Power Plants take over the load to provide from 350 to 2000 watts of electricity when—and where—it is most needed. Precision engineered Briggs and Stratton engines run up to five hours on one gallon of gasoline. Replacement parts are available all over the world.

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DIVISIONS | EMC ELECTRIC MOTOR CORPORATION
Cyclohm MOTOR CORP.

WIRING 17,000 HOUSES

[FROM PAGE 57]

6. Install cable circuits
7. Make splices and connections
8. Install outlets, switches and fixtures

Each specialized crew worked progressively from house to house repeating the same operation; followed other crews in the order indicated above. To preclude loss of efficiency due to monotony of repetitive operations, many crews, except those on circuit work, were switched from time to time. A spotting crew might install boxes or drill holes and vice versa. Such specialization paid off in minimum training and general speed-up of installations.

Tools, Materials and Methods

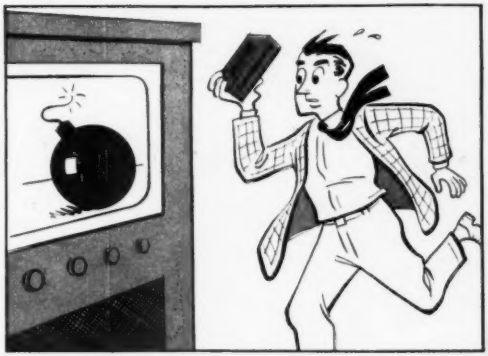
While crew organization was a factor in overall project efficiency, much credit is due the use of labor-saving tools and materials plus a maximum degree of pre-assembly of parts. Power tools were used wherever possible, with portable generator sets before distribution lines were available and with temporary power poles after the lines were in. Each temporary pole had receptacles providing 110 and 220-volt single-phase, grounded outlets for tools; normally served ten houses; was moved to another location later. In all, about 300 such poles were used throughout the project to serve all trades.

An apparently small, but important, item was the issuance of automatic (push type) screw drivers to electricians on pre-assembly and "finish" work. The few seconds or minute saved on each operation mounted to an impressive over-all total; proved a wise investment on part of the contractor. Wire strippers and crimp connectors were used by the circuit crews.

Additional labor economies were realized by using a combination weatherproof, flush-type, meter socket and load center cabinet requested by the contractor and furnished wired by the manufacturer. (Mild California climate makes exterior location of load centers practical). Minutes were saved on each switch and receptacle installation by choosing one-piece switch and receptacle assemblies (cover plate and receptacle is a one-piece molded plastic unit). Warehousing and handling time on this item was also materially reduced.

Pre-assembly techniques were employed wherever possible. Most of this

You can do a lot



with a little

GOLD SEAL TAPE

Come what may, veteran linemen and electricians know they can depend on Gold Seal. It tapes up tight and makes a longer *lasting* bond. Reason? Production is laboratory-controlled by Jenkins Bros.

That's why the fresh, tacky feel of Gold Seal will not dry out. Why roll after roll tears evenly, quickly, without raveling at the edges. Why, in short, Gold Seal *goes further* — there's less waste.

Ask your supplier, next time, for Gold Seal Tape. Try it on your toughest jobs. See if it doesn't help you produce better-taped joints, and more joints per roll. See if you don't agree that Gold Seal is tops in tape!

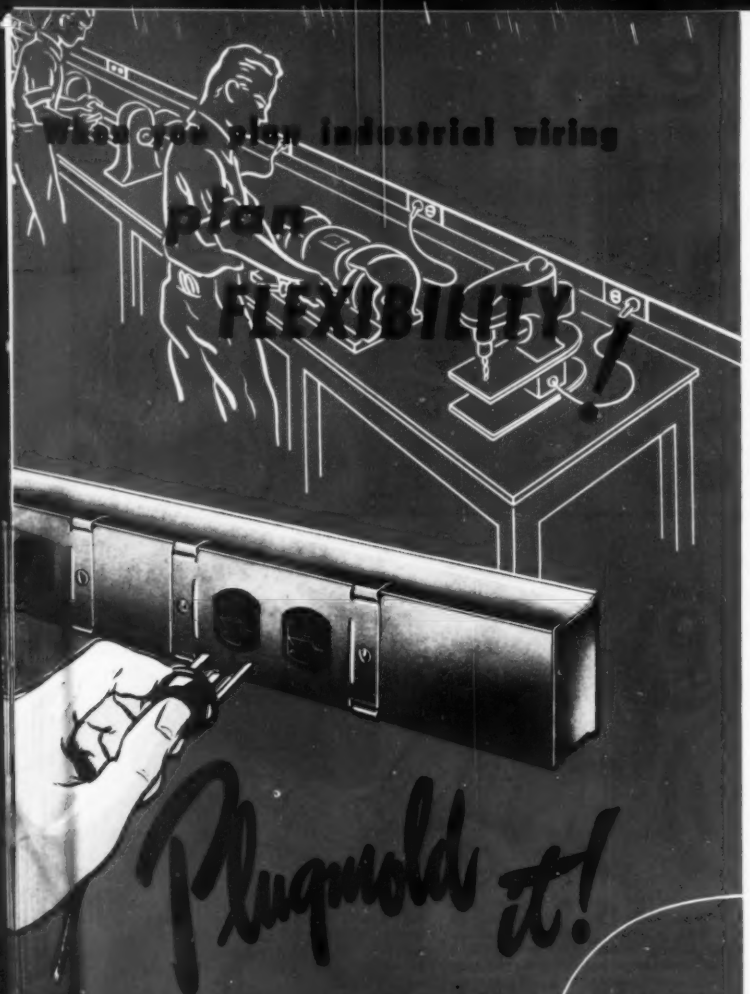
In single rolls and handy 10-roll containers. Each roll cellophane-wrapped to keep it *factory-fresh*. Jenkins Bros. (Rubber Division), 100 Park Ave., New York 17, N. Y.

Jenkins Bros. also make Diamond Seal Friction and Rubber Tapes which meet both ASTM and Federal Specifications.

JENKINS Gold Seal Tape

FRICTION and RUBBER TAPES

MADE BY JENKINS BROS. . . . MAKERS OF FAMOUS JENKINS VALVES



A heavy duty multi-outlet system, 3000 PLUGMOLD is widely used for industrial applications requiring closely-spaced, correctly located receptacles for the handy plug-in of small motors and electric tools.

An important feature of the 3000 system, the 3046 line of cover fittings provide a wide range of flexibility. New additions to this line include the 3046K cover that accommodates Quick-Leg type circuit breakers to control individual circuits or devices . . . and the 3046L for Fustat units. Other covers permit use of single receptacles, duplex receptacles, tumbler switches, surface devices, sign receptacles, conduit devices, and fixture and drop cord. Easily installed, covers are furnished with clips that (a) serve as wire clips, (b) support device in the raceway and hold it securely in place. Clips line up device with cover, save wiring time!

3046K
Circuit Breaker Cover

3046L
Fustat Device Cover

The 3000 System can also be installed as risers and as a branch circuit system . . . to feed out-of suspended lighting fixtures.

THE WIREMOLD COMPANY
HARTFORD 10, CONN.

IW1001

3 BASIC PLUGMOLD SYSTEMS

1900 — Light duty plug-in-anywhere wiring system, for outlet connections. Available wired, unwired or as SPANPICOIL.

2100 — A plug-in-anywhere wiring system with a capacity larger than 1900. Furnished unwired.

3000 — Heavy duty plug-in-anywhere system for industrial applications. Also serves as branch feeder system.

was done in the two central field shops where all materials were delivered direct from the suppliers. Bundles of ¾-inch EMT conduit were cut in half to provide the 5-foot service mast. Conduit, meter cabinet and service wires were assembled (with threadless fittings) as a complete unit at the rate of 50 per day per man. Actual service installation at the house then took only 10 minutes per man, plus another 10 minutes for grounding.

Plug cords for garbage grinders were assembled at the contractor's home shop and delivered in bundles to the project.

Ceiling outlets and hangers were assembled on a bench jig, banded together in groups of nine (enough for one house) and delivered with the necessary wall boxes to the houses in cardboard tote boxes. A similar scheme was used for the "finish" items —receptacles, switches, fixtures, and chimes. Each morning K-W trucks (there were 28 of them on the entire project) left the central field shop loaded with material scheduled to be installed that day. Everything was at the house when installation crews made their rounds.

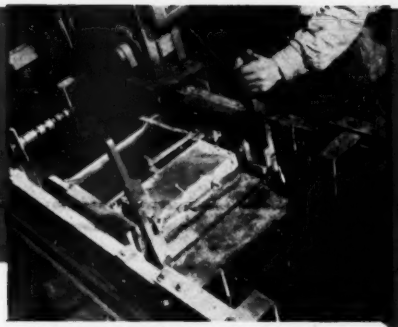
Pre-cutting of branch circuit cable was considered but discarded as impractical because of possible dimensional variations in various houses. Considerable saving of cable was effected by having the wiring crew use a coil of non-metallic sheathed cable (suspended on payout reel from a rafter hook) and cut it to length as needed during circuit installation.

Close coordination between the highly organized installation crews, pre-assembly crews and field foremen kept the electricians in step with—and sometimes ahead of—other trades on the project. Estimated time per house for complete wiring ranged from 18 to 20 man-hours. During a five-month period an *average group* of 50 electricians wired 3,000 houses on a straight-time, 5-day week—or an average of 27 homes per day. At peak, a single group breezed through 35 houses per day—or a total of 70 per day for the two-group project. Kuster-Wetzel is reaping the benefits of its organizational talents and job know-how.

FRONTIERS FOR ELECTRICAL PROGRESS

The July issue of ELECTRICAL CONSTRUCTION AND MAINTENANCE will include an appraisal of modern practices and trends in load analysis for wiring design.

The Plus Factors which make OKOLITE-OKOPRENE Your Best Buy in Electrical Cable



Before coating conductors with Okoloy, the annealed copper wire is electrolytically cleaned, thoroughly scrubbed, wiped, rinsed and wiped again.

From the inside out, every component of Okonite cable has a *plus value* which adds to cable life. That's because the Okonite manufacturing process carries on from where conventional cable design leaves off. The finished cable is a combination of all these exclusive Okonite developments—the best that modern research and manufacturing techniques can produce.

CONDUCTORS — not "tinned", but Okoloy-coated.

INSULATION — not just rubber, but natural Wild Up-River Fine Para rubber.

PROTECTIVE COVERING — not just another neoprene compound, but the pioneer, time-proved Okoprene formula.

PROCESSING — not the commonly used extrusion method, but the famous Okonite precision strip-process.

VULCANIZATION — not with life-shortening "double-cure", but with strength-retaining single vulcanization in a metal mold.

TESTING — not just a single voltage test, but both high voltage a-c and super-voltage d-c tests.

The Okoloy process was introduced in 1928 to offset two factors frequently encountered in tin conductor-coatings which lessen long cable life—1) tin coatings readily alloy with copper in the processing bath and, as a result, some copper always remains in contact with the rubber insulation; and 2) the sulphur contained in the rubber compounds then reacts with and destroys the tin-copper coating which in turn exposes the copper conductor, eventually causing deterioration of both the conductor and the rubber insulation.

Okoloy affords protection against both these factors because it is a lead alloy. Of all common metals, lead is least damaged by sulphur acids. Moreover, lead does not alloy with copper under the condition encountered in coating conductors. Because processing baths are not contaminated with copper the Okoloy coating is pure throughout. It adheres strongly to the copper conductor, and surrounds it with an acid-resistant, flexible coating which contributes materially to longer life of both rubber insulation and conductor.

This is only one of the six principal plus factors which contribute to the extra-long life of Okonite cables. For detailed information on OKOLOY, write for Bulletin EC –2019 to The Okonite Company, Passaic, N. J.

THE BEST CABLE IS YOUR BEST POLICY

OKONITE SINCE 1878 *insulated wires and cables*

8605

600 Fifth Avenue, New York City

Architects: Carson & Lundin
Mechanical Engineers: Jaros, Baum & Bolles
Electrical Engineers: Smith & Silverman
Builders: Turner Construction Co.
Electrical Contractors: J. Livingston & Co.

Planned TODAY for TOMORROW'S Electrical Loads

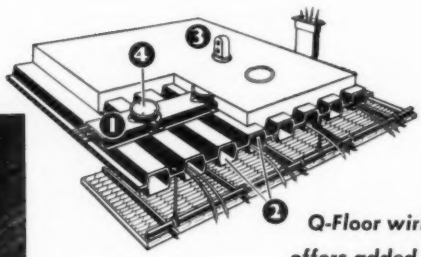
with G-E Q-Floor Wiring

This new building at 600 Fifth Ave., New York City, now under construction by the Massachusetts Mutual Life Insurance Co. is another to join the ever-growing list of modern office buildings which were planned, during the blueprint stage, for future electrical flexibility.

By specifying a General Electric Q-Floor wiring system, provision has been made for increased power loads and unforeseen changes in office layout throughout the entire life of the building. If changes are necessary, tenants won't be disturbed nor vital building facilities disrupted, because the Q-Floor raceway network places additional power or communication outlets within six inches of any point on the floor. To add a new outlet a small hole is drilled through the top of the raceway cell. Then the outlet is wired and set into place—that's all there is to it! Outlets can be removed just as easily when they are no longer needed.

For complete information on wiring installations for new commercial, industrial, or institutional buildings, contact your nearest G-E district office or H. H. Robertson office. Or write to Section C12-218, Construction Materials Department, General Electric Company, Bridgeport 2, Connecticut.

Raceways go in as the Q-Floor is laid, because—with G-E Q-Floor wiring—the floor *is* the raceway system. Each floor cell is a complete raceway, ready to receive wire, ready for electrical changes any time during the life of the building.



Q-Floor wiring system offers added electrical flexibility

1 Header duct—at right angles to Q-Floor—carries wire from load center to cells.

2 Cells serve as raceways for power, signal, and telephone systems.

3 Floor outlets are installed by drilling Q-Floor cells at any point.

4 Junction units in header duct permit easy access to wiring at any time.

You can put your confidence in—

GENERAL ELECTRIC

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other problems — turn the page for the answer

We suggest that you tear out the bottom card before you start reading the following pages. Keep the card handy. You might even use it as a book mark in case you are unable to complete reading the following pages at one sitting. Then, as you see some new products about which you want to know more, just circle on this card the number which appears at the top of the item describing the new product or catalog. Circle each number on this card which corresponds to the number on the item in which you are interested.

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330 West 42nd St.
New York 18, N. Y.

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Electrical Construction and Maintenance is written for you by a large staff of editors and consultants, each an authority on some phase of the business. They will be glad to give you expert advice and answers to your questions.

...their problems" turn this page for the answers.

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Reader Service Department

ELECTRICAL CONSTRUCTION AND MAINTENANCE

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New York 18, N. Y.

USE THIS CARD TO ASK THEM!

Do you have a problem in wiring layout, motor control, lighting technique?

Ask the editors.

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Ask the editors.

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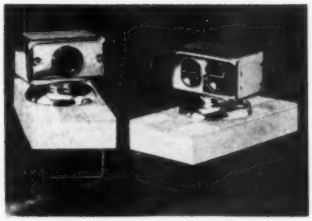
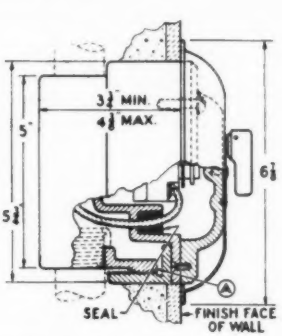
Product News



Service Fittings (1)

Two new service fittings for high and low potential wiring, designed for use with underfloor wiring systems, have been announced. Innovations include a height of only 3 inches from floor to top of fitting; and a chrome finish. Fitting No. 7903-H has standard duplex T-slot receptacles for use with high potential light, power or office appliance wiring. Companion unit No. 7904-HL is equipped with a single 3 x ¾ inch composition bushing for telephone, buzzer and inter-communication wiring in plant offices and office buildings. They are equipped with a one-inch nipple which provides ample capacity from the duct into the service fitting. A bondnut locks the housing to the nipple. Both models are furnished with adapters to screw into standard 1½ inch outlets of underfloor wiring distribution systems. No. 7903-H can be furnished with three pole twist-lock receptacles.

National Electric Products Corp., Chamber of Commerce Bldg., Pittsburgh 19, Pa.

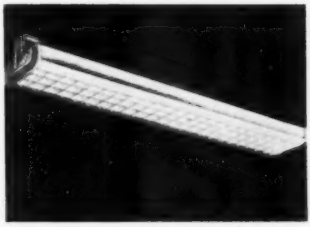


Tumbler Switches (2)

A newly designed heavy duty factory sealed tumber switch in adjustable flush mounting, explosion-proof enclosure, is available. The line has been designed to meet all Underwriters' requirements for Class I, Groups C and D classifications. Available in 1 and 2 pole, three and four way. Furnished with switch unit and conduit box either with polished chromium plated cover or aluminum gray baked enamel finish. Switch unit includes tumbler switch with pigtail leads in factory sealed housing, adjustable collar and finishing cover. Minimum depth of wall required for units is 3¾ inches, from finished surface.

Russell & Stoll Co., Inc., 125 Barclay St., New York 7, N. Y.

(3)



LOUVERED Slimline lighting fixtures have been announced for use in commercial and industrial establishments. Available in 4, 6 and 8 foot lenghts and with 2, 3 or 4 lamp units, these instant-starting fixtures use T-12 430 ma. single pin lamps. Louver cutoff is 30° crosswise and 30° lengthwise. A special "Trunk-Lock" hinge fastens to either side of fixture permitting easy relamping and maintenance. Manufactured by Mitchell Manufacturing Company, 2525 N. Clybourn Avenue, Chicago, Ill.

Hanger (4)

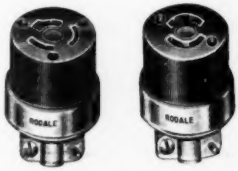
A new "Quick Grip" slide hanger which allows one-man installation of its line of fluorescent Trimline lighting fixtures has been introduced. This slide grip hanger permits support of fixture at almost any convenient position on ceiling, usually determined by ceiling supports, desired symmetry of stems, or location of wiring outlets. For best load distribution, it is advisable to use two hangers per fixture and position them as close to fixture ballast as is practical. After hanger is fastened on a stem or directly to ceiling, the fluorescent fixture is brought up into slide grip.

Sylvania Electric Products Inc., 1740 Broadway, New York 19, N. Y.

Local Lighting (5)

Two new series of models of localized lighting equipment, for machines, benches, etc., have been introduced. Both carry the Underwriters Laboratories label. One series, known as "412", incorporates flexible adjustable tension joints to permit workers to position lights to suit individual "seeing" requirements. The joints are designed to allow adjustment of tension according to the needs. The other series "400 utilizes strong flexible tubing to gain flexibility. In both series of models wiring is totally enclosed. Mounting bases are designed to fit regulation outlet boxes or they may be fastened to any flat surface. Sockets are keyless porcelain type. Switches are toggle type incorporated in the mounting base. Parabolic or elliptical shaped reflectors are available on both series.

Fostoria Pressed Steel Corp., Fostoria, Ohio



Cord Connector Bodies (6)

Four cord connector bodies designed to match the present Turn-Tyte line of armored attachment plug caps and flush receptacles. For 2 and 3 wire—10 and 20 amp service. There is ample spacing around terminals for quick easy wiring. Cord diameter—.500 for 10 amp connector bodies—.625 for 20 amp. Listed by Underwriters' Laboratories. Interchangeable with other interlocking devices now in use.

Rodale Manufacturing Company, Inc., Emmaus, Pa.

midwest

midwest electric mfg. co.
1639 walnut st • chicago 12, ill.

MODERN FITTINGS FOR

- thinwall conduit
- rigid conduit
- metallic and non-metallic cable
- flexible steel conduit
- service entrance cable
- grounding devices
- lighting fixture fittings

manufacturers for over 30 years

Sold Through Electrical Wholesalers

representatives in principal cities

Gravity Feed Oilers (7)

Large capacity gravity feed oilers are now available in 10 oz., 1 pint, 1 quart and 2½ quarter capacity Pyrex glass or lucite plastic reservoirs. With lock ring or ratchet feed adjustment, they are designed to feed any predetermined number of drops per minute. Recommended for applications on large stationary bearings, machinery, journals, conveyor drive chains, etc.; wherever a large quantity of oil is required or when it is desirable to extend reservoir refilling time as long as possible. When shutoff lever at top of oiler is in upright position, oiler feeds at set rate. When lever is flipped to side, oil feed stops. Also available with lock-nut on sight fitting for tightening to mounting bracket and with a compression fitting for connection to copper or Neoprene tubing.

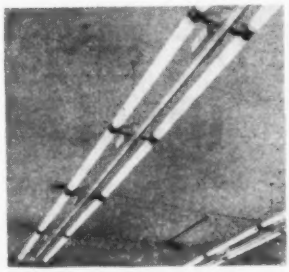
Trico Fuse Mfg. Co., 2948 No. 5th St., Milwaukee 12, Wis.

Motor Starter (8)

A new motor starter, called the Motor Watchman, Class 10-100-S1, is available. With ratings up to 600 volts, 6½ hp polyphase, 5 hp single phase; or 220 volts, 1½ hp dc, it starts, stops, and provides overload protection for single phase, polyphase and dc motors. Self-indicating handle, interlocked cover that prevents opening unless starter is "off", and safety latch to lock starter "off" during servicing are personnel-protection features. Positive motor-protection is provided by quick-make, quick-break, over-center toggle mechanism—De-ion arc-quenching—and bimetallic disc-type thermal overload relay.

Westinghouse Electric Corp., Pittsburgh 30, Pa.

(9)

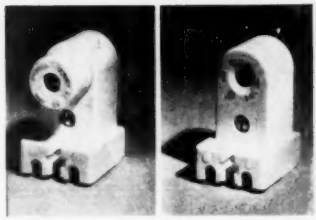


LOW BRIGHTNESS unshielded flourescent lamps (40-watt T-17) are featured in the new Ainsworth Budgetlite fluorescent luminaire. Designed for installation as individual 2-lamp suspended units, or as continuous row 2-lamp suspended units, the five-foot long lamps are supported by simple lampholders attached to a metal spine of pleasing design which houses a special long-slim type ballast. Brightness of the T-17 40-watt lamps and their surrounds on light finished ceilings are said to be within a ratio of "ten to one," considered permissible for comfortable lighting. The unshilded lamps also simplify maintenance. Ainsworth Lighting, Inc., 3810 29th St., Long Island City, 1, N. Y.

Surface Type Floor Box (10)

A new watertight, non-adjustable floor box for mounting on top of the floor has recently been announced. Known as No. 724, the box has a T-slot receptacle with neoprene gasket and brass screw-cover plate. The 2-inch brass cover fits in a 2¾-inch O. D. brass finishing ring. Overall height is 2¼ inches. Cast iron body has two ½-inch holes drilled and tapped in bottom. Number 704-2NP, 704-2, and H-704-NP floor nozzles will fit the base.

Lew Electric Fittings Co., 627 West Lake St., Chicago 6, Illinois



Lampholder (11)

A "fixture type" slimline lampholder has been introduced. It is intended for single screw fastening. Designed for either surface or flush mounting, these lampholders are considered ideal for use in exposed lamp type fixtures. The high voltage device is provided with a spring loaded movable contact for easy lamp insertion and removal. The unit on the right is used on low voltage. As a mounting accessory for use with "plunger type" butt-on slimline lampholder, a U-bracket has been added. Both lampholders will accept all slimline type lamps including the 75 watt T12 size.

Sylvania Electric Products Inc., 1740 Broadway, New York 19, N. Y.

Electric Oven (12)

A new portable industrial electric oven has been announced. Features include uniform temperature throughout. Fresh air is drawn in and stale air driven out through specially located vents by means of a fan driven by a motor mounted on the outside of the unit. Adjustable damper gives wide range of constant temperature. Oven is so constructed that one will nest on top of the other. They can be used in groups and can be operated as individual ovens or selected ovens in the group can be cut-out or heated at different temperatures. Models CR-1 has single phase 110 volt motor. It can be operated from any 110 volt outlet. DC units are available. Size is 29 inches wide, 24 inches deep, 20½ inches high, inside. Removable shelf and drip pan are standard equipment.

Grieve-Hendry Company, Inc., 1101 N. Paulina St., Chicago 22, Ill.

Make Stronger, Safer Pigtail Splices!

THE NEW

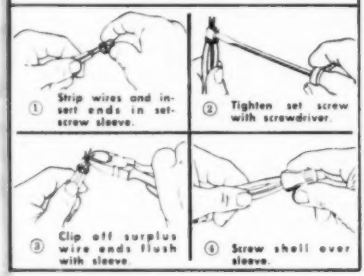
IDEAL

SET SCREW

WIRE CONNECTOR

PERMITS VISUAL INSPECTION OF JOINTS AT ANY TIME

...Easy to Use...Safe


① Strip wires and insert ends in set-screw sleeve.
② Tighten set screw with screwdriver.
③ Clip off surplus wire ends flush with sleeve.
④ Screw shell over sleeve.

Approved FOR 600 VOLTS AS PRESSURE CABLE CONNECTORS FOR GENERAL USE

● With IDEAL Set-Screw Connectors you can make perfectly insulated, *super-safe* splices in branch circuit wiring, fixture hanging, machine and appliance hook-up—in just a few seconds per splice! They let you make changes in circuit layouts easily—just unscrew and re-use the same connectors! Or inspect joints at *any* time! Extra-long, extra-strong—IDEAL Set Screw Connectors offer you a new high safety factor that eliminates chance of flash-overs at higher voltages and insures against service failures. They are corrosion-resistant—shake-proof—pull-proof—built to be safe for a lifetime by IDEAL, for 27 years the contractor's first choice for precision-built, top-performance wire connectors. Try IDEAL Set-Screw Connectors on your very next job!

IDEAL FREE SAMPLE

IDEAL INDUSTRIES, Inc.
1041 Park Avenue, Sycamore, Illinois

Please send us free samples and catalog information on the new IDEAL Set-Screw Connector.

NAME_____

COMPANY_____

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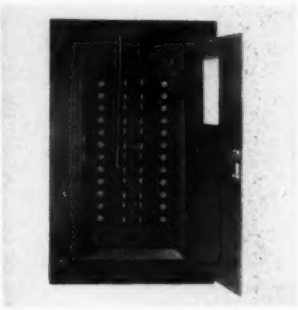
CITY_____ ZONE___ STATE_____

Two sizes, listed by Underwriters' Laboratories, Inc. for all common wire combinations

Sold Through America's Leading Distributors



Panelboards **(13)**

These new NTPR panelboards provide plug fusible branches with heavy duty toggle switches for lighting and appliance branch circuit control. They are available from 4 to 40 circuits for use on either ac or dc applications. They carry Underwriters' Laboratories, Inc., approval. Construction features embody a 17 in. wide by 4¼ in. deep box with 4 in. wide wiring gutters. Ample knockouts are provided in ends and sides. Four branch circuits are contained in the bakelite blocks which comprise the heart of these panelboards.

Square D Company, Roosevelt Park Annex, Detroit 32, Mich.

Remote Control **(14)**

New improved mechanical remote control for Speed-Trol (variable speed) electric power drives has been announced. It is designed so that it can also be adapted to any Speed-Trol, now in use. Remote control is available in a variety of types, such as with extended flexible cable, or with an extended rod with universal joint, right angle bevel gear with extended rod, chain and sprocket, or a combination of any or all of the above. A remotely located speed indicator with handwheel is also available. This type of control permits variable speed drives to be more adaptable on more applications where remote control from a distance is beneficial or necessary. It has been designed so that the operator will always have the handwheel control at his fingertips.

Sterling Electric Motors, Inc., Telegraph Road at Atlantic Blvd., Los Angeles 22, California

Incandescent Lamp (15)

A new all white incandescent lamp, known as "Tru-White", which gives almost total diffusion without glare or loss of lumen efficiency, has been developed. It is being produced in standard sizes. It is an all white bulb, processed by a new technique with a newly created substance which gives an all-over luminous glow when lighted. The processing, which gives the all-over luminous quality, is on the inside of the bulb and it is not affected by atmospheric conditions. The coating is fused into the glass.

Duro-Test Corporation, North Bergen, N. J.

Generators (16)

New Tri-Clad high-speed synchronous generators have been announced. Available in four basic designs, they have ratings from 1.875 to 50 kva. Designated as Types ATI, ASI, and ATB, they have frequency ratings of 60 and 400 cycles. Three standard types of 60 cycle generators are offered, providing a range of characteristics for several different categories of voltage regulation and motor starting requirements. The basic 60 cycle design is an externally regulated generator designed to operate with standard voltage regulator in the exciter field circuit. Standard excitation voltage is 64 volts, but equipments suitable for 125 volts excitation are available. Ratings at 60 cycles vary from 2 kw, single phase to 15 kw, 3 phase. A modification of this line provides self regulated features for applications where average voltage regulation and motor starting ability is desired. The third 60 cycle line involves the basic 60 cycle generator, and a special overhung amplidyne exciter, and a static voltage regulator, wrapped in one package. The high-frequency, 14-pole, synchronous generator is the 4th design in the line. Suitable for applications which require 400 cycle power, the 14-pole unit is designed for military ground power engine- or m-g, etc.

General Electric Co., Schenectady 5, N. Y.

Let IDEAL Tools Save Time and Cut Costs on Every Wiring Job..

FISH TAPE, REEL AND PULLER (Patented No. 1,890,945)

3 tools in 1—

Cuts Fishing Time in Half!

Even long conduit runs are easy to handle when you have the BIG, sure pull afforded by an IDEAL Reel and Puller. Tape is always under safe control—in the conduit or locked in the Reel—easy to reel in or pay out—can't kink or spring loose. Complete with tape of finest flat spring steel, oil tempered. Five stock sizes and lengths —50′ to 200′.

FLUR-TEST

Fluorescent Fixture Tester

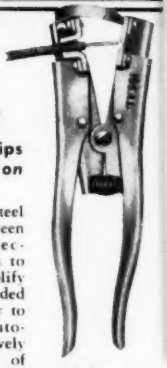
Shows Source of Trouble, Right at the Fixture!

Saves time and effort in testing fluorescents. Shows in just a few seconds, right at the fixture whether failure is in the fixture circuit, the tube or the starter. Prevents needless discard of good tubes. Models for 15-40 and 85-100 watt fixtures with exposed starter or with adapter for starter behind tube.

"E-Z" Wire Stripper

Strips Clean, Strips Fast and Saves on Wire!

The rugged, all-steel stripper that has been a stand-by of electricians for years to speed up and simplify stripping of stranded or solid wire. Easy to use as pliers. Automatic stop positively prevents crushing of stranded wire. V-notches on blades save wire by eliminating accidental scoring or cutting of wire. Portion of hardened, replaceable blade also serves as a wire cutter. Six sizes handle all wire gauges from 8 to 30.



Wire Pulling LUBRICANT

Provides a film of lubricant that speeds up wire pulling and protects insulation against strains and breaks. Makes it easier to add wires to conduit already containing wires or to remove wire from conduit. Non-corrosive, non-combustible and non-injurious to hands or clothes. For lead or plastic covered wire or cable. (Not for asbestos covered wire.) Quarts or gallons.

IDEAL WIRING TOOLS ARE SOLD THROUGH AMERICA'S LEADING DISTRIBUTORS

IDEAL FREE CATALOG DATA

IDEAL INDUSTRIES, Inc.
1041 Park Avenue, Sycamore, Illinois

Please send catalog data on:

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- ☐ "E-Z" Stripper
- ☐ Wire Pulling Lubricant
- ☐ FLUR-TEST

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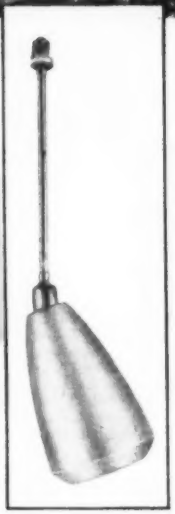
GIVE MOST FOR YOUR MONEY!

Amplex Swivelites in department store jewelry section.



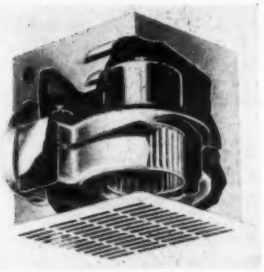
HERE THEY ARE . . . 5 reasons why Amplex Swivelites are your one best buy for accent lighting:

1. Smartest modern design;
2. Enduring, glossy satin aluminum finish;
3. Airflow ventilated hoods reduce burn-outs;
4. Double-ball swivel with instant, positive, fingertip control;
5. "Adapt-a-Unit" construction; basic units completely interchangeable.

Get the whole Amplex Swivelite story. Just write Amplex Corporation, Dept. C-2, 111 Water Street, Brooklyn 1, New York.

AMPLEX

Sealed-Beam Reflector Lamps, Colorbeam Lamps, Spotlites and Floodlites, Industrial Infra-Red Heat Lamps, Vibration and Rough Service Lamps, Street Lighting Lamps, Traffic Signal Lamps, Incandescent Lamps, Fluorescent Tubes, Display Accessories.



Ventilator (17)

Equipped with a time-delay switch, this bathroom ventilator will exhaust all odors, dampness and steam from shower or bath before automatically shutting itself off. Switch can be set for any period up to 30 minutes. Unit is installed in ceiling and vented to outside. A 4-inch blower wheel, driven by a 1/75 hp motor which delivers 100 CFM is used. Motor in unit is located entirely outside the air stream. Housing, which incorporates a conduit box and handy knockouts, is permanently installed in ceiling joist space. Blower unit is installed or removed from housing by means of a positive friction catch and electrical plug. Chrome-plated grille is quickly removable. Overall dimensions are 6⅛ inch deep by 8¼ inch wide by 7¼ inches high. Discharge is horizontal through standard 4-inch round pipe.

Trade Wind Motorfans, Inc., 5725 S. Main St., Los Angeles 37, Calif.

Small Floor Outlet (18)

Recently announced small, non-adjustable, watertight floor outlet box has an over-all diameter of only 2¼ inches at the top with a 2-inch screw cover plate. Designated as No. 750, the unit comes equipped with a T-slot receptacle and neoprene gasket; has one ½-inch threaded hub in bottom; is 2¼ inches high. Box is made for use in mosaic or marble floors where small opening is desirable; can also be installed in other type floors.

Lew Electric Fittings Co., 627 West Lake St., Chicago 6, Illinois

Alarm System (19)

Announcement has been made of a new electronic smoke alarm system, which sets off alarm at first spiral of smoke and is adaptable as burglar alarm. System involves use of a photoelectric cell and sensitive amplifier, used in conjunction with a light beam projector that covers extreme areas. An electric outlet box is required near photoelectric cell, and another should be placed near light beam projector. Two wires are connected to cell and alarm. Where partitions between spaces are encountered small holes of 3 to 6 inches in diameter are drilled, permitting light beam to pass through. For burglar alarm system, an infrared ray is used in light beam projector to produce an invisible light beam.

Valley Forge Safe-Eye Alarm Service, Lansdale R.R. 1, Pa.

Load Centers (20)

A new line of load centers 40-100 amp, 1 through 20 circuits, for residential and commercial applications, has been introduced. Known as "Trumbullite" load centers they are constructed with removable free-floating interiors which are mounted on captive springs, making it possible to line up interiors for flush mounting irrespective of boxes except on load centers with 40 ampere mains. Load centers include TQL breaker. Fronts are embossed to show ON and OFF positions of breakers, handle trip indication and circuit numbers. Each front has two openings, with twist-outs for additional circuits. Load centers are furnished in six sizes to accommodate 1 to 20 circuits. Breakers of all sizes from 15 to 50 ampere are physically interchangeable in load centers. 12 through 20 circuit load centers permit sequence phasing.

Trumbull Electric Manufacturing Company, Plainville, Conn.

3 wire polarized

LEVITON

flush receptacle

RATED 15A.-125V.
10A.-250V.

New and Improved!

Another Engineering Triumph from the Leviton Line

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Meets with REA specifications

SEE THE COMPLETE LEVITON LINE AT ALL LEADING DISTRIBUTORS

CORD GRIP CAP

- Large, heavy, sectioned bakelite body 1½" outside diameter.
- Brass blades with large binding head screws.
- Hole for cable .460" diameter.
- Sturdy 2-screw clamp ¾" long for cord grip.

RECEPTACLE

- Sturdy one-piece bakelite moulded body.
- Double spring phosphor bronze contacts.
- Large binding head screws.
- Underslung strap of heavy guage steel, cadmium-plated and permanently attached.
- Fits standard wall plates (Leviton No. 1904).

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The "Dreadnaught" not only adds materially to the attractiveness of any slimline installation but it incorporates:

High efficiency lighting . . . Instant starting (no starter needed) . . . Compact, streamlined design . . . Sturdy construction and the versatility of the turret socket into an outstanding slimline luminaire that is easier to install and maintain.

"Dreadnaught" Luminaires are available in lengths to accommodate all Slimline lamps from 42" to 96".

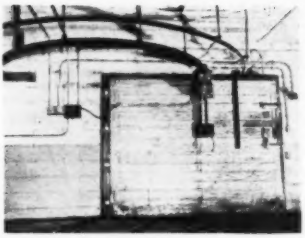
77 DR 2-96-430 provided 85 foot candles at 100 burning hours. They were flush mounted on 12' centers and spaced on 7'6" centers. 44 ST 2-96-200 Sign Track Units were used to illuminate signs.

"Dreadnaught" and other Magna-Lite Luminaires are fully described in our new Catalog including complete ETL Reports, Design and Construction Data, Mounting Details and Accessories. Write for your copy, today.

METALCRAFT PRODUCTS CO., INC.

Manufacturers of Fluorescent Slimline Luminaires

306-308 CHERRY STREET • PHILADELPHIA 6, PA.



Door Operator (21)

Announcement has been made of new automatic operator which can be used for operating any swinging doors, in factories, commercial institutions, etc. The friction drive affords maximum safety to persons or property. In case door or gate is blocked so that it cannot go through its normal cycle, friction rollers will slip until obstructing object is removed from under door or in a few seconds, the automatic electrical overload cuts-out and stops operator completely. A door or gate equipped with operator can be opened or closed by standard push-button controls, or magnetic remote control from cars or trucks operated by drivers while cars or trucks are in motion, or by any desired combination of these controls. Ten different remote controls are available. Operator comes equipped with low voltage remote controls.

Robot Appliances, Inc., 13165 *Prospect Ave., Dearborn, Mich.*

Service Equipment (22)

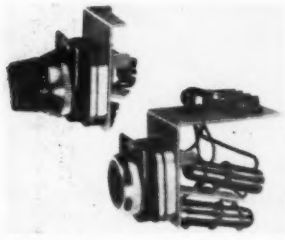
A new special purpose unit, consisting of magnetic circuit breakers as well as receptacles in one enclosure, has been announced. Receptacles are wired-in. Equipment is available with one to four fully magnetic breakers in combination with one or two receptacles. Ratings are supplied in any combination up to 50 amps each. It is for construction work and other jobs where portable tools are used. It can be installed on job after job. Tem-

porary circuits for such apparatus as drills, sanders, compressors, pumps, saws, motors, floodlights, etc., are established by plugging in equipment to convenient outlets. Covers can be padlocked to prevent tampering, and fully magnetic, non-thermal circuit breakers provide protection on overloads and short circuits. Equipment is enclosed in corrosion-proof steel housing which measures up to 15 inches high, 6½ inches wide, and 3½ inches deep for largest size. Breakers will carry rated current continuously.

Heinemann Electric Co., Trenton, N. J.

(23)

SWIVEL TYPE lighting unit, No. 718A, has been introduced. It can be adjusted 360° horizontally, 180° vertically. Standard finish, satin-brushed aluminum. Also available in satin brass, satin bronze, satin copper, green, terra cotta, and chartreuse. Arms come in 9, 12, 15, 18 and 24 inch lengths. Underwriters approved. Manufactured by Litecraft Manufacturing Corporation, 790 Wythe Avenue, Brooklyn 11, N. Y.



Safety Switch **(24)**

For safety in hazardous, explosive locations, a mercury switch with either pushbutton or selector knob has been developed. Unit consists of a hermetically sealed mercury switch mounted

THE ELECTRICAL FACTS AND DATA YOU NEED... at your fingertips!

Here, in a convenient-sized book to take on the job, are hundreds of working facts needed constantly by the practical electrical worker—selected by a man fully familiar with the electrical job field and its every-day problems. The ELECTRICIANS' POCKET COMPANION answers your questions; gives you needed data based on the National Electrical Code and Underwriters' requirements; tells what to do in solving literally hundreds of electrical problems; contains dozens of tips for faster, better work. Priced so low you can't afford to be without it . . . . only $3.50.

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Formerly Electrical Inspector, New York City

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- **Details and wiring diagrams on automatic control of domestic heating systems**
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Hundreds of tables, charts, diagrams and data compilations cover modern electrical work and equipment. Code requirements are outlined. Trademarks are identified. Important code tables are given in large, readable type. Practical methods and short cuts are described on dozens of subjects ranging from working with conduit, armored cable, open wiring, meters, motors, controllers and transformers to lighting and signal circuits or domestic heating systems.

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9. Lighting and Signal Circuits
10. Insulation Resistance testing
11. Electrical Equipment Troubles
12. Illumination Values
13. Residence Wiring Systems
14. Electrical Symbols and Abbreviations
15. Useful Information
16. Electrical Formulas and Their Applications
17. Electrical Code Tables, Diagrams and Examples
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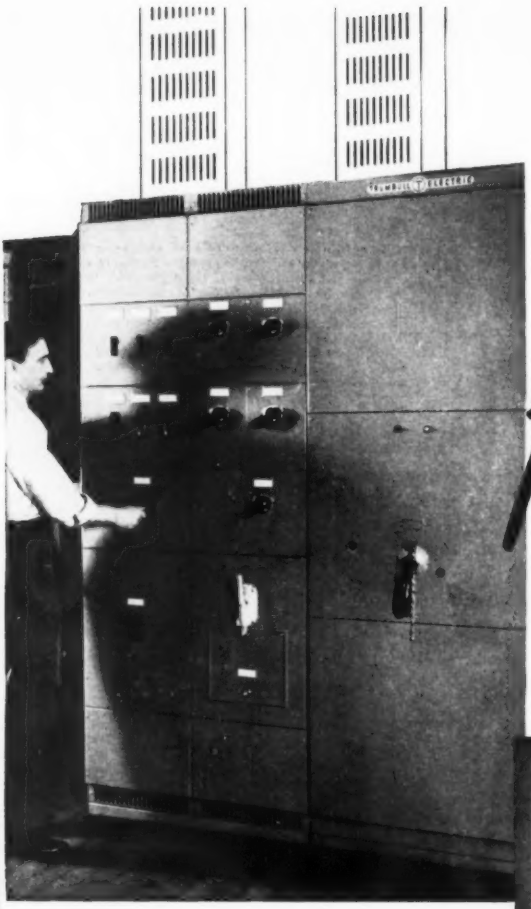

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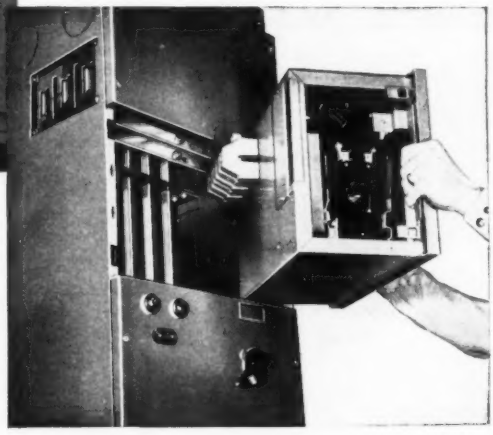


New Features Save Floor Space, Speed Up Wiring, Facilitate Operation

LESS FLOOR SPACE NEEDED

Compact trough design allows more troughs to be used in a given area of floor space.

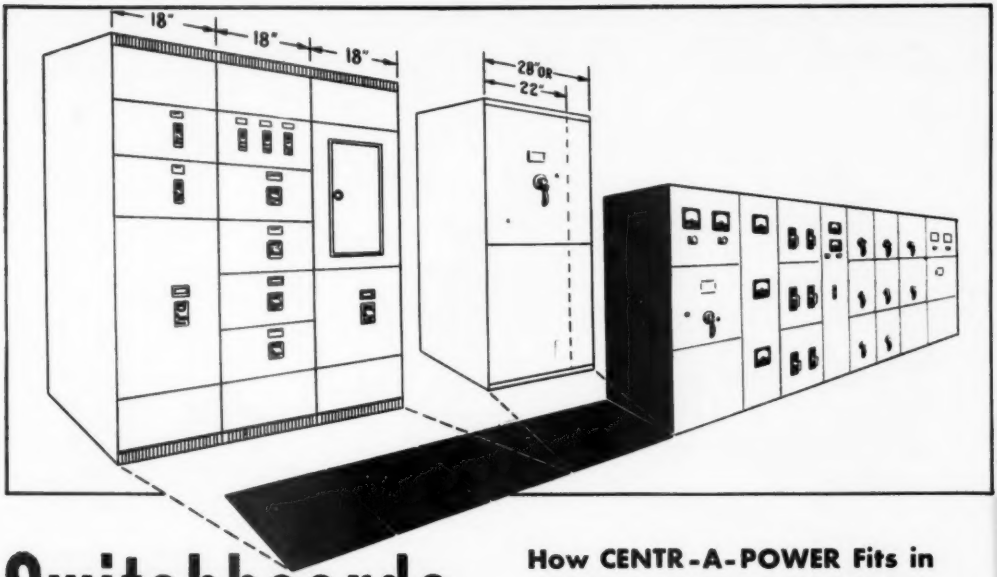
LOTS OF ROOM FOR WIRING

Generous (4 x 8 in.) wiring gutter makes wiring easier —can be accomplished with units in the trough—and allows use of over-size cable on long runs, keeping voltage drop low.

ACCESSIBLE FROM FRONT

CENTR-A-POWER Switchboards are completely accessible from the front, permitting aisle, back-to-back, "L" and "U" installations, further saving floor space.

TRUMBULL'S TRAINLOAD OF NEW PRODUCTS



Switchboards

. . . at money-saving prices

To save you money on installation time and maintenance costs, Trumbull has designed a new type of switchboard for complete low voltage (600 V and under) switching requirements. Because of pre-engineering and standardization, you can now have the highest quality construction at the lowest possible cost. Here are some of the features:

Pre-fabricated, rigid steel troughs can be placed in any arrangement to provide a completely dead-front, totally-enclosed switchboard. Wiring gutter design is such that load wiring is isolated from incoming load bus. Compact switch or breaker units, called CENTR-A-PLUGS, are easily mounted or removed. A quick-clip attachment saves time in installation, inspection and maintenance. Self-aligning latches replace bolts and nuts. Positive connection to bus bars is assured by use of spring-loaded, reinforced stabs. Each CENTR-A-POWER unit self-contained and electrically isolated from adjacent units.

How CENTR-A-POWER Fits in with Your Present Rigid Type Switchboard Equipment

CENTR-A-POWER is made from three standard troughs, all 90 in. high. At left is unit type CENTR-A-POWER with 18 in. trough; it handles fusible switches through 200 amp. and circuit breakers through 600 amp. Two standard section troughs are indicated in the center. Type A is 22 in. wide, handles 400 and 600 amp. fusible switches. Type B is 28 in. wide, handles fusible switches through 1200 amp. and circuit breakers through 1600 amp.

Unit-Type Troughs (18 in.) are furnished assembled or unassembled. Large standard sections are furnished assembled only.

ASK ABOUT TRUMBULL CENTR-A-POWER CONTROL CENTERS

which are of similar construction and line up mechanically and electrically with CENTR-A-POWER Switchboards.

New Free Bulletin—Address The Trumbull Electric Manufacturing Company, Plainville, Conn. Ask for Bulletin TEB-3.

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ONE SIGNAL or a COMPLETE SYSTEM!

it's the "NAME" THAT ASSURES DEPENDABILITY

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Whether you're contracting for a complete new system or merely repairing or adding to an old one, you know the value of NAME BRAND signals and systems. Over many years, names like Stanley & Patterson, Faraday, Holtzer-Cabot, Sperti have meant the best there is and thousands of installations everywhere have proven their dependability. Next commercial or industrial signal problem, consult your local Sperti Faraday Branch Office or Representative! He can be most helpful in economical planning of the job!

it's SPERTI for ULTRA-VIOLET SANITIZERS

Hospitals, schools, industrial plants, offices, public buildings, retail stores, even homes—know the name, Sperti, when it comes to ultra-violet Sanitizers. Germ laden air, particularly in winter months when windows are closed, is purified and bacteria killed with Sperti ultra-violet Sanitizers. Many types of fixtures available—some combined with incandescent light. Write for Sperti Ultra-violet catalog.

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BELLS • BUZZERS • HORNS • CHIMES • ULTRA-VIOLET SANITIZERS • VISUAL AND AUDIBLE PAGING DEVICES AND SYSTEMS

on a lever-operated armature. To operate switch the selector knob is turned or button pushed which inclines the armature thus actuating the mercury switch. Switch is designed for vertical panel mounting and is a single pole switch with either double or single throw action. Push-button models feature a spring action that returns the switch to original position when finger pressure is released. Selector switch type can be set in either "on" or "off" position.

Panalarm Products, Inc., 7212 No. Clark St., Chicago 26, Ill.

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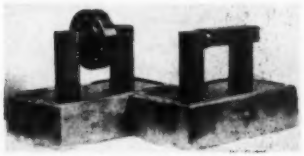
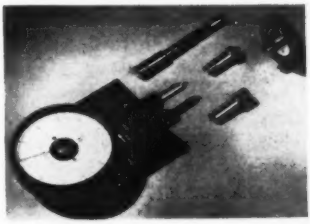
(25)



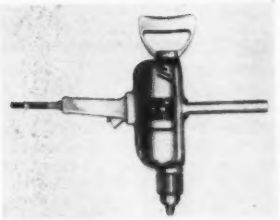
INDUCTION HEATER for heating ball bearings preparatory to installation. Left-hand view shows large bearing; right-hand view shows bearing adapter with small bearing. It is fast, insures uniform heating and expansion as recommended by bearing manufacturers. Keeps bearing clean, and heated ready for installation in 1½ minutes for small bearing to 5 minutes for large bearings. Operates on 110 volt ac. For use in motor repair shops and electrical maintenance departments. Manufactured by Kalen Electric and Mfg. Co., Eugene, Ore.



Instrument **(26)**

The new Smiths model A.T.H. 10 dual range hand tachometer features low torque, 0.40 oz. inches on lowest range. Ranges are 0/1000 rpm and 0/5000 rpm. Each range is printed on dial in a contrasting color. Instrument is provided with knurled knob for range selection and pushbutton on either side for releasing and/or holding pointer at machine speed indication. Packed in carrying case, with male and female centers, 3½ inch extension and 6 inch circumference surface measuring disc.

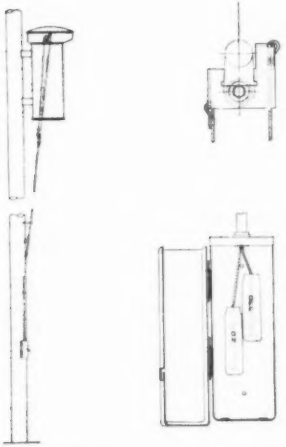
Equipoise Controls, Inc., 100 Stevens Avenue, Mt. Vernon, N. Y.



Electric Drills **(27)**

Four completely redesigned electric drills have been introduced. Models 82, 2101, 2103 and 2121 range in capacity from ½ inch to ¼ inch in steel and up to 1½ inch in hardwood. The ½ inch and ⅝ inch models are heavy duty, high speed drills, weighing 14½ lbs. and measuring 16¼ inch in length. High torque, low speed models are available in ⅜ inch and ¼ inch capacities. Speeds run as low as 250 rpm and as high as 1000 rpm. All models have die-cast aluminum alloy housings, over-size ball bearings, needle bearings, helical gears and geared chucks. Morse taper sockets are available in place of geared chucks.

Skilsaw, Inc., 5033 Elston Ave., Chicago, Ill.



Control Device **(28)**

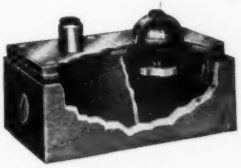
A control device for operating the breaker reset handle of pole mounted CSP transformers from ground level is available. Device is especially useful for turning on and off sports lighting or for other special applications where power is supplied by CSP transformers. Two control cables are attached to a special bracket mounted on the breaker handle. These run down the pole in conduit and termi-

LATROBE

FLOOR BOXES — WIRING SPECIALTIES

PRODUCTS

QUALITY THAT LASTS



No. 252-R Two Gang Adjustable Floor Box

Neat and practical with No. 208 Receptacle in one section. One Cover Plate has ½" Flush Brass Plug; other has 2".

No. 150 Floor Box
No. 207 Nozzle

Soundly constructed with 4 ¼" Cover Plate and large Adjusting Ring No. 215. Can be very quickly installed.

100% Convenience and 100% Reliability Make "Latrobe" Products Popular Everywhere

The simple, compact design of "Latrobe" Floor Boxes and Wiring Specialties makes them so easy to install, so dependable in service. Made of the finest materials available, "Latrobe" Products offer true economy.

Sold Only Through Wholesalers

No. 110 "Latrobe" Watertight Box

Unique, compact design unexcelled for service in concrete or wood-finished concrete floors. Cover Plate 3 ½" diam.

No. 284 Nozzle
No. 200 Cover Plate

Furnished with ½" or ¾" brass pipe extension, this trim Duplex Receptacle Nozzle is built for dependable service.

BX Cable Staples

Millions of these high quality staples are in use all over the country. Packed in cartons, kegs or barrels.

"Bull Dog" Insulator Supports

Safe and sure for clamping porcelain or glass insulators to exposed steel frame work. Four sizes.

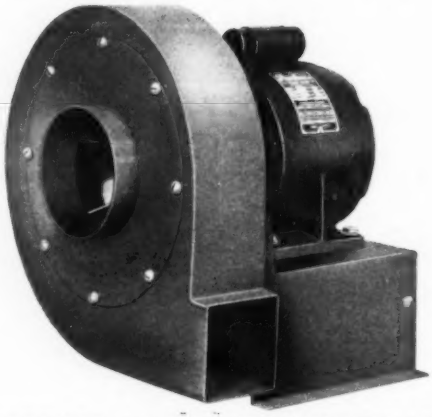
EASILY INSTALLED

FULLMAN MANUFACTURING CO. LATROBE, PA.

ECONOMICAL

Peerless Electric

PRESSURE BLOWERS
FOR SMALL EXHAUST SYSTEMS AND FOR CONVEYING, COOLING, ETC.



PRODUCE A LARGE VOLUME OF AIR AT HIGH STATIC PRESSURES

● **Peerless Electric pressure blowers are designed to produce a large volume of air at high static pressures with the advantages of a self cleaning paddle wheel.**

These blowers are recommended for small exhaust systems where air is laden with dust or grit, and also for supplying high pressure air for conveying, cooling, etc.

The blowers are made in four sizes, with motors of ⅛, ⅓, ¾ and 2 H. P., and wheels 7¾ x 2, 9 x 2½, 10⅝ x 2½, and 12½ x 2½, respectively.

WHEELS — Constructed with straight radial blades supported on a heavy back plate with heavy cast-iron hub, dynamically balanced and designed for efficient operation.

HOUSINGS — Arc-welded 16-gauge steel housings and motor bases for rigidity and long life.

MOTORS — Standard blowers furnished with single phase Capacitor-Induction type or three phase Induction motors. All are equipped with ball bearing, rigid mounted motors. Also available in other current characteristics for special applications.

ROTATION and DISCHARGE—Furnished for clockwise rotation, bottom horizontal discharge unless otherwise specified. At time of installation housings or wheels may be turned for other discharges and rotation if so desired.

CAPACITIES — Tested and rated in accordance with codes adopted by National Association of Fan Manufacturers and the American Society of Heating and Ventilating Engineers.

GUARANTEE — Units are guaranteed against defective workmanship or material for a period of one year from date of shipment from factory. Each unit when shipped is registered and the serial number identifies it immediately for spare parts or duplicates.

Write for sheet giving complete specifications and prices.

THE PEERLESS ELECTRIC COMPANY

Established 1893 • **WARREN, OHIO**

Peerless Electric
MOTORS • FANS • BLOWERS

nate in a control box mounted on pole at a convenient height above ground. Strain insulators eliminate possibilities of voltage in control box. Operation is by pulling steadily on one of the handles until the transformer breaker handle assumes the "on" or "off" position. Breaker can also be reset after automatically tripping by pulling "off" handle as far as it will go and then closing breaker by pulling the "on".

Westinghouse Electric Corp., Pittsburgh 30, Pa.

Watertight Floor Box (29)

A newly announced watertight, non-adjustable floor box comes with T-slot receptacle and neoprene gasket to make unit watertight at floor level. Unit is 2⅛ inches high, has 2-inch diameter brass screw-cover plate in brass ring at floor elevation. Receptacle may be interchanged with No. 704-2NP, 704-2, and H-704-NP floor nozzles.

Lew Electric Fittings Co., 627 West Lake St., Chicago 6, Illinois

Industrial Oven (30)

A new type of industrial oven construction composed of low-cost electric heater panels and standardized frame members has been announced. It uses rod-type heaters mounted on insulated oven wall sections. This combines high-speed radiant heating with temperature-controlled convection for industrial heating and drying operations up to 700°F. Ovens of any size, shape and heat capacity can be field-assembled from standard parts by electric maintenance personnel. Since no welding is required for assembly, ovens can be enlarged, extended, or dismantled with changes made in the heating transfer rates, when and as required, by the addition or removal of standard catalog parts. From 4 to 40 kilowatts of heat may be installed in each 26 inch by 84 inch panel.

Advance Heating Division, Jensen Specialties, Inc., 9331 Freeland, Detroit 28, Mich.

Product Briefs

(31) Wasserlein Mfg. Co., Inc., Joliet, Ill., has introduced the WASSCO glo-melt panel accessory, Model WL-333B2, for attachment by users to standard **Glo-Melt units.** . . .

(32) New **pyrometer equipment,** which offers accurate temperature indication, close temperature control of industrial processes and protection for furnaces, ovens and kilns, has been announced by General Electric Co., Schenectady, N. Y. . . . (33) Oxford Electrical & Purchasing Service, Rochester, N. Y., has developed a new **belt preserver,** known as Belt-ite, which is a liquid that is applied to leather, canvas or composition belts to preserve them and keep them clean.

(34) The Barry Corporation, Watertown, Mass., has announced new, small, air-damped shock and vibration **isolators.** . . . (35) Five Proto universal **power sockets** and a universal joint, employing a ball-type coupling, have been announced by the Plomb Tool Company, Los Angeles, Calif. They are designed for pneumatic or electric power-impact wrenches with ½ inch square drive. . . . (36) Skilsaw, Inc., Chicago, Ill., has introduced a new 1 inch **drill,** Model 163. Combined with American Handiwinch it can also be used as a power hoist.

(37) Announcement has been made of a new **water fog** for fire protection, known as Foghed. It has been developed for use in fixed piping systems for the protection of such hazards, using automatic or manual controls, or both. It is manufactured by Fog Nozzle Internation, Division of Akron Brass Mfg. Co., Inc., Wooster, Ohio. . . .

(38) South Chester Corporation, Philadelphia, Pa., has announced a new portable hydraulic **hoist.** . . . (39) A new atomic **radiation detector** to permit direct radiation readings at a glance has been announced by General Electric Co., Schenectady, N. Y.

(40) The Electric Motor Corporation Division of Howard Industries, Inc., Racine, Wis., has redesigned and improved its model 800D shaded pole **motor,** rated 1/200 to 1/80 hp. . . .

(41) Ward Leonard Electric Co., Mount Vernon, N. Y., has introduced a new model A-20 Chromaster industrial **chrome plating** unit. . . . (42) Shur-seal cover clamp and inhibited oil are two new features of Form W distribution **transformers** manufactured by Wagner Electric Corp., St. Louis, Mo.

(43) The Silicone Paper Company of America, Inc., N. Y., has developed a **silicone-treated tissue** for cleaning goggles and glasses in factories and offices. Sheets are interfolded for handling in a dispenser. Known as Magic Lens Tissue, it uses GE silicone.

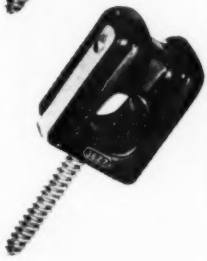
PROTECT YOUR REPUTATION

Specify and Install

Blackhawk Industries
FITTINGS AND FIXTURES

BLACKHAWK WIRE HOLDERS

No. 3626. Heavy steel base and supporting strap with No. 22 square shoulder screw. Cannot slip or turn when screwed into wall or pole. All parts hot dip galvanized. 2⅞" base supports insulator, relieves tension on screw when wire is pulling at an angle. High quality porcelain insulator has compression strain only. Smooth, rounded surfaces protect wire insulation. 1" hole. REA approved. 2½" screw length. No. 3626-3 has 3" screw.



No. 3627. This top quality porcelain insulator is reinforced with a heavy gauge steel yoke and held together with a solid steel pin. Porcelain has compression strain only. No. 22 sharp point screw has square shoulder swaged to the harness and cannot slip. Harness is hot dip galvanized. Average vertical pull test 2250 lbs. Average 45° angle pull test 1875 lbs. 2½" screw length. No. 3627-3 has 3" screw.

ASK FOR B-I WHEN YOU BUY

Sold only through electrical wholesalers

BLACKHAWK INDUSTRIES
Dubuque, Iowa

Blackhawk Industries

Entrance Cable Fittings - Sill Plates - Box Supports - Conduit Entrance Caps - Staples - Connectors - Cable and Conduit Straps - Locknuts and Bushings - Wire Holders - Yard Lights - Fluorescent Brackets

LEW *Electric* FITTINGS

NON-ADJUSTABLE WATERTIGHT FLOOR BOX

For mounting on top of floor. Overall height 2⅛". Diameter of cover 2". brass finishing ring 2¼ O.D. Cast iron body has two ½" holes drilled and tapped in bottom of base.

LEW gives you QUALITY ALL THRU

It will be LEW for you once you use this quality line of dependable Electric Fittings. Here are products that contractors from far and wide are using exclusively. They find them right for each job. You too will give them a big O.K. Use LEW as your electric fittings hearquarters—it pays big.

• ALL ADJUSTABLE FLOOR BOXES HAVE PERMANENT, SHAKE PROOF, ELECTRICAL BONDING SCREWS, AND ARE UNDERWRITERS APPROVED

←WATERTIGHT FLOOR BOX

Non-adjustable floor box with only 2" opening in floor. Has four ½" holes drilled and tapped in bottom of base. Shown with floor nozzle. Can be used as single receptacle flush in floor with bell nozzle.

SINGLE GANG FLOOR OUTLET BOX→

Adjustable. Also made in two and three gang. Made of cast iron with lugs for mounting. Underwriters Approved. Cover plates arranged to drain water outside of box.

FLOOR OUTLET BOXES

Adjustable—deep and shallow bodies. The body of box is drilled and tapped for either ½" or ¾" conduit.

Non-adjustable—the cast body has three ½" holes in sides, two in bottom. Completely assembled.

←SMALLEST FLOOR OUTLET BOX

Non-adjustable. Watertight. One ½" threaded hub in bottom of box. Requires 2" opening in floor.

THINWALL BENDER

Has toe release hook which returns automatically to the starting position by simply touching the release arm with the toe after conduit is formed. The only bender which can be released from conduit with very little effort. Cat. No. 226.

DOUBLE DUTY ½" and ¾" and 1" E.M.T. FORMING TOOLS

Only forming tool with release hook. The hook on our bender gives perfect alignment of conduit in channel of bender at 90°.

No. 222—½" or ¾" double duty.

No. 223—¾" or 1" double duty.

SINGLE DUTY CONDUIT BENDER

Thinwall—for 90° elbows. Has automatic toe release hooks.

CAT. NO.	SIZE
221	½"
224	¾"
1223	1"

Lew Electric Fittings Co.

627 W. LAKE ST. • • CHICAGO 6, ILL. • • STATE 2-7114 • • 7115

CATALOGS and BULLETINS

(44) 60 AMPERE BUSWAY system, recommended for the sewing and cutting fields, is illustrated in 24-page bulletin 21. Feedrail Corp.

(45) MERCURY PLUNGER relays are specified, diagrammed and discussed in terms of maintenance, in catalog 17. H-B Instrument Co.

(46) SQUIRREL CAGE totally-enclosed non-ventilated induction motors, 7½-hp at 1800-rpm and 5-hp at 1200-rpm, are discussed in bulletin 1215. Fairbanks, Morse and Co.

(47) WELDING ALLOY chart, containing specifications on nearly 100 different low temperature alloys for welding, hard surfacing and brazing is available from Eutectic Welding Alloy Corp.

(48) ELECTRIC BROODERS for chicks and other young stock are illustrated in bulletin 130-51. Steber Mfg. Co.

(49) RELAYS AND SWITCHES for industrial control are subjects of 90-page catalog 4071-F discussing products, selection, mounting data, characteristics and ordering information. International Automatic Electric Corp.

(50) GENERATORS with built-in automatic constant voltage characteristics are sketched, specified and discussed in 16-page booklet 2100-PRD-202. Electric Machinery Mfg. Co.

(51) INSULATING OILS regenerated, explained with the use of charts, pictures and text, is subject of process application sheet 50-DO. Sharples Corp.

(52) ELECTRICAL FITTINGS, such as solderless wire connectors, cable and conduit fittings and wiring devices, are contained in 12-page catalog 1050. Buchanan Electrical Products Corp.

(53) CIRCUIT PROTECTORS for residential applications are discussed with pictures, wiring diagrams and specifications in multi-fold mailing piece. Murray Mfg. Corp.

(54) LOW-RANGE LIMITS BRIDGE designed for high-speed sorting of resistors and other electrical components whose resistance must be checked against all allowable ohmic tolerances is subject of bulletin 8A. Associated Research, Inc.

(55) BATTERIES for motive power service, for users of materials handling and haulage vehicles, are explained in loose leaf booklet. The Electric Storage Battery Co.

(56) HAND AND FOOT VALVES are discussed and sketched in bulletin 303. Ross Operating Valve Co.

(57) PORTABLE TOOLS for the manufacturing and construction fields, including saws, drills, blowers, grinders, sanders, etc., are presented in 74-page 2-color catalog 50. Skilsaw, Inc.

(58) HOW TO SPECIFY lighting units for better planned lighting is subject of 4-page bulletin 1050. RLM Standards Institute.

(59) SAFETY SWITCH designed to operate either audible or visual alarms when liquid levels reach predetermined points is discussed and diagrammed in file bulletin 7500. Automatic Control Co.

(60) INSPECTION LIGHTS with dust- and moisture-proof sockets, suspension hooks, extension cords and handle extensions are pictured and specified in file bulletin 4-1950. Commercial Reflector & Mfg. Co.

(61) HOME LIGHTING display suggestions include ideas for presenting school study center, laundry, sewing, portable lamps, fixtures, dining room and dresser illumination. General Electric Co.

(62) ALLOYS AND FLUXES for welding, brazing, soldering, cutting and tinning are specified and discussed in 32-page pocket-sized booklet. All-State Welding Alloys Co., Inc.

(63) VOLTAGE REGULATED POWER supply models 315, 510, 515 and 500R are discussed in series of 2-color file sheets. Kepco Laboratories, Inc.

(64) TANK TYPE CLEANER that can be converted into a hand-type blower is described in 2-color mailing piece. Ideal Industries, Inc.

(65) INTERIOR LIGHTING booklet B-5254 is 16-page suggestion manual for schools, offices, variety stores and other commercial buildings. Westinghouse Electric Corp.

(66) HEAVY DUTY CRANE with ½-yard capacity and lifting range from 8 to 12½ tons, powered by either diesel or gasoline, is subject of 2-color catalog released by American Steel Dredge Co., Inc.

U-D-T Fixture Hangers'

3-way locking speeds installation!

Helpful as another pair of arms, these solid-gripping GUTH U-D-T Hangers allow one man to hang fixtures quickly and securely:

1 Ceiling bridge is attached to ceiling or outlet box.

2 Stems are locked into fixtures and canopy slipped on stems.

3 Stems are hooked onto ceiling bridge and canopy fastened to bridge. Fixtures are leveled quickly with handy set screws atop their channels.

GUTH

NEW LOW-PRICED U-D-T Hangers are available for both single and double stem attachments. See the U-D-T at your GUTH distributor today —or write for Bulletin 873-A.

Guth LIGHTING

THE EDWIN F. GUTH COMPANY / ST. LOUIS 3, MISSOURI

Leaders in Lighting since 1902

SANGAMO *Heavy Duty* TIME SWITCHES

Choose Sangamo Heavy Duty Time Switches for long life performance. This exceptional ability to maintain continuous operation is due to the Sangamo developed and built low-speed 450 R. P. M. motor—eight times slower than the 3600 R. P. M. motor used in many other time switches. Low speed means less bearing wear, consequently more years of service. Lifetime lubrication provided by a special Silicone grease unaffected by temperature extremes.

Other features that mean year after year of troublefree automatic control include: rugged, oversize full capacity silver to silver contacts—heavy machine cut precision gears—all carefully assembled and thoroughly tested.

The Sangamo line is complete—a large variety of special control features to meet your needs. Choose one of these high quality time switches at your electrical wholesalers for your next installation. The slightly higher price is soon forgotten—but the quality remains.

SANGAMO ELECTRIC COMPANY

SPRINGFIELD, ILLINOIS

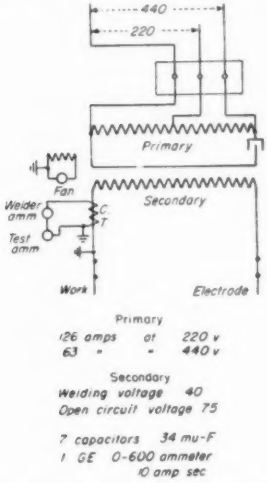
Get the full story—write for Catalog No. 1010-A today.

QUESTIONS from readers on problems of industrial equipment, installation maintenance and repair. Answered by electrical maintenance engineers and industrial electrical contractors out of their experience. For every question and every answer published we pay $5.00.

Reader's Quiz

Indicating Ammeter

QUESTION P-17—I found the indicating ammeter on a welding transformer not reading correctly and connected an indicating ammeter in series with welding transformer ammeter and



the second ammeter read correctly. I finally revised secondary connections on original ammeter and it read correctly. Why was that necessary? Above is wiring diagram from welding transformer nameplate.—V.E.T.

ANSWER TO P-17—I know of no ac ammeters where it matters how the leads are connected as far as polarity is concerned. However, the circuit diagram shows the ammeter circuit to be grounded. It may be that there is a ground in the meter coil also and that this is affecting the reading. If there is a ground in the meter, then this would affect the reading regardless of the way the leads are connected. However, if the ground is near one terminal of the meter, there would be little error if this terminal is connected to the grounded side of the circuit and a very large error if it were connected to the ungrounded side. —R.J.S.

ANSWER TO P-17—An ac ammeter that is not guarded from external magnetic fields will not read correctly, because the current will push the pointer to 375 amps while the external field may push the pointer forward or backward. By feeding the current through both meters in the same direction, you had the same external field for both meters.—H.S.

Heating Iron Pipe

QUESTION N-17—On our fuel oil storage system we have a ten inch iron pipe line twenty feet long that gives us trouble during cold weather from thickening of the oil. Would it be possible to heat this pipe electrically in the same manner that frozen water pipes are thawed out? If so, how would one go about designing the necessary transformer?—W.P.R.

ANSWER TO N-17—To prevent the oil from thickening no specially designed transformer is necessary. On 115 volts ac or dc, the use of lead sheathed industrial heating cable, wrapped spirally on a pipe, and properly insulated, would do the trick. The heating cable supplies the heat lost through the insulation, and the oil does not lose any heat, and therefore will not thicken.

An accurate reply as to the amount of heating cable to be used is not possible without more complete information, but here is an estimate based on the following assumptions.

Assume that the oil is at the same temperature entering and leaving the pipe: that is, the heating cable will supply all the heat losses. Also assume that the difference between the oil temperature and the ambient temperature is 40°F. With a one inch covering of magnesia insulation, the heat losses would be slightly over 2000 Btu per hour, or about 590 watts.

At 115 volts, a 60 foot length of cable is rated at 400 watts. Therefore, based on the previous assumptions, two lengths at 115 volts each, would be more than sufficient. Of course, under other conditions, the amount of heating cable will vary.

A thermostatically operated switch would provide automatic control as the heat is needed. This should be connected so as to be controlled by the temperature of the pipe.

It should be apparent that this set-up would be considerably less expensive than designing and building a special transformer.—J.E.B.

ANSWER TO N-17—I would not recommend the consideration of heating your 20 foot fuel pipe with transformers similar to the method as may be used in thawing pipes as you mention.

First the heating requirements are not as much as for thawing and secondly the cost would be too high for the job you want to do. Any good handbook will give you suggestions on the use of transformers for this purpose. Generally, you have to use two with primaries in series and secondaries in parallel to get about 60 volts for use—using of course standard and not special transformers. Then for further decreasing the current you change the reactance of secondary circuit and this can be easily done by looping your leads.

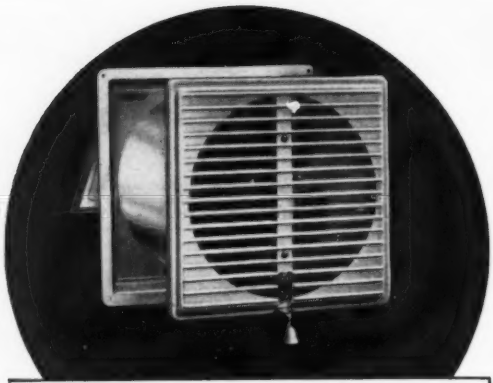
As mentioned, this is out of order for the purpose. What you should use (assuming you have 110 volt house voltage) is a 60 foot length of heating cable. With this use a thermostat. The thermostat is directly mounted on the pipe. With this system you have an entirely automatic system and the cost is only a fraction of the one you have in mind.—E.A.M.

Transformer Oil

QUESTION E-16—What precautions must be taken when filtering oil from an energized transformer? What should the minimum dielectric strength and maximum acid content be before filtering is required? Under what conditions would it be cheaper to replace the oil than filtering it?—J.J.L.

ANSWER to E-16—When filtering oil from an energized transformer, it is important to draw oil from bottom of tank, through filter, then return oil to tank near top, *but under surface of oil to prevent aeration.* It is recommended that it is much safer to disconnect equipment from line before filtering.

A.S.T.M. standard procedure with regard to transformer oil gives the following recommendations:



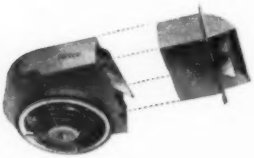
Gives houses more sales appeal

FASCO

AUTOMATIC KITCHEN VENTILATOR

Modern kitchen efficiency, beauty and comfort are the first concerns of every new-home-minded woman. That's why so many builders find it *easier to sell homes* equipped with FASCO Kitchen Ventilators. They spell real kitchen comfort to any housewife . . . keep her working room clean and cool at all times by instantly expelling steam, grease and cooking odors. A FASCO-ventilated kitchen instantly appeals to every housewife.

Inexpensive FASCO Automatic Ventilators move more air for less money. The FASCO Outside Wall Ventilator (illustrated above) completely changes the air in the average kitchen every 3 minutes—quietly and economically. Positive weathertight seal is provided; all outside parts are rustproofed. Designed for quick, easy installation; fit any wall thickness. Available in 8" and 10" blade size models.



FOR CEILINGS, INSIDE WALLS

The Fasco "Ceil-N-Wall" Ventilator has the new FASCO Turbo-Radial Impeller. It delivers more air through a 10' standard duct—with less noise—than any other type of blade or wheel used for this purpose. Eliminates drafts and air re-circulation. Single or 3-speed operation. Easily mounted in ceilings, through cabinets, or in inside wall directly above stove.

WRITE OR WIRE TODAY for complete information.

FORMERLY F. A. SMITH MFG. CO.

FASCO Industries, Inc.

ROCHESTER 2, N.Y.

Oil O.K. if:

1. Neutralization number between 0 and .04
2. Dielectric above 22,000 volts
3. Spec. Grav. not over .898 at 60 Fht.
4. Color reasonably good

Filter oil if:

1. Neutralization number between .04 and .09 *or*
2. Dielectric is 20,000 to 22,000 volts

Replace oil if:

1. Neut. number is above .09 *or*
2. Dielectric is below 20,000 volts *or*
3. Spec. Grav. is above 0.9 *or*
4. Trans. has overheated and shows signs of sludging.

The following information may be of interest:

Dielectric strength of reconditioned oil should be at least 22,000 volts. Neutralization number should not exceed 0.08 mg. of KOH per gram of oil, with no trace of alkali.

Standard Dielectric Test Cup has circular discs of polished brass or copper, 1" in diameter, with square edges. Gap of 0.1 inch. Raise voltage at rate of 3000 volts per second.

Summing up, answer to question part A, return oil under surface at top of transformer. Part B, minimum dielectric is 22 kv. and maximum acid content is 0.08. Part C, when small quantities of oil have been contaminated by fire extinguishing agents, it is cheaper to replace than attempt to reclaim. Oil contaminated by carbon tetrachloride or soda sulphuric acid cannot be reclaimed. Oil with acid content over the maximum can be replaced by new oil cheaper than the acid contaminated oil could be refined. —E. J. S.

Signal to Operator

QUESTION F-16—We have a three phase, 440 volt crane operating from a trolley system some 300 feet long. At times it is very difficult to attract the operator's attenion. Could someone suggest a practical means of signaling to the crane cab using the trolley system as a conductor?—W.P.R.

ANSWER to F-16—There are several practical methods which can be used to attract the crane operator's attention.

First, and probably best, is to install trolley phone units, one in the cab and the other at some convenient point in the plant. These units have very clear reception and can be heard by the crane operator and dispatcher regardless of external plant noises.

The trolley phone would eliminate the need for hand signals in moving materials, as two-way conversation can be carried on. This should add to the

safety of the crane operation. Details for installation can be obtained from any manufacturer.

A second method, not using the trolley system, would be to use walky-talkies; with the one in the cab mounted so that the aerial would not be shielded by the cab, nor come in contact with any of the external metal or trolley.

A third method would be a signal system using an old time radio in the cab, and an oscillator down in the plant tuned to make an audible signal. The oscillator could be on a key switch so that the signal could be sent when needed. The aerial from the set would have to extend from the cab so that the oscillator signals would not be shielded from it.—C.F.S.

Automatic Reset

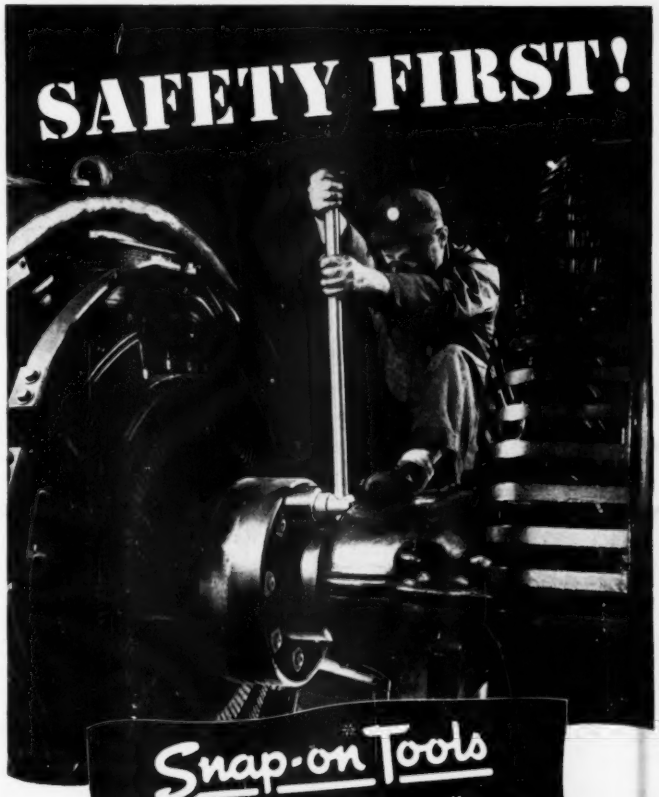
QUESTION H-16—An alarm horn is installed to sound an alarm when any one of several contacts closes. Alarm closes a small 2 pole relay, one pole lighting an amber light for that particular alarm contact and the other pole connected in parallel with several other similar relays operated from other alarm contacts, so that the horn will sound when any one of the alarm contacts closes. A switch is installed in series with the horn so that it will be used to cut out the horn until the trouble is cleared. It is then supposed to be reclosed, but quite often no one thinks about closing the switch, with the result that the alarm horn is of no benefit. I would like to know how the alarm system may be connected so that, if possible, the horn can be cut out by some means when desired, but that the system will automatically reset when the alarm contact opens and the amber light goes out, so that the alarm horn is ready for the next operation without any further attention being given to it.—C.B.T.

ANSWER to H-16—Sketch below shows a simple solution. It is an electronic time delay relay using a miniature 2D21 Thyratron tube.

Connected as shown in sketch, this timer will respond to any desired number signal circuits.

When all is normal the circuit appears as shown in sketch.

Assume current supply connected, grid condenser C is charged through grid-cathode rectification to the polarity indicated. This bias prevents tube from firing at once when alarm contacts close L 1 leg of line through to 2D21 cathode, which is connected to the open side of all signal relays paralleled horn contacts. Thus the timer



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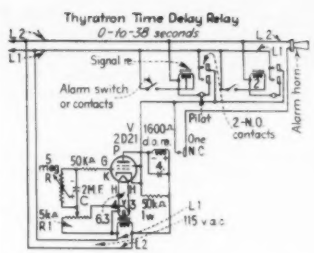

will go into action on any closed signal relay.

Now assume circuit one develops trouble, alarm switch closes signal relay, pilot light goes on and horn starts blasting. Horn contacts have connected Tube V2C21 across the line. Assume the time period for horn to blow 30 seconds. Condenser C charge equals approximately 105 V for a 30 second time period. Grid of V is then minus 105 V. A 2D21 fires whenever grid bias reaches 3 to 5 V minus value, call it 5 V tube variation.

This simply means it takes 30 seconds to discharge C from a value of 105 V down to a value of 5 V. Tube V then fires when grid reaches 5 V value and ½ wave rectified current of 95 M. A. flows through its plate relay closing same, this opens the L 1 leg to horn, silencing horn, which remains out of circuit just as long as alarm contacts remain closed.

When alarm contacts break, dropping signal relay, pilot goes out, L 1 leg is disconnected from cathode of 2D21 which then ceases to draw current, drops its plate relay which cuts the horn back in circuit. C is then recharged in a few cycles, and circuit once again appears as shown in sketch, ready for any alarm signal.

If longer horn blasting periods are desired, increase value of C to 4 or 8 M. F. The 8 M. F. value will blast the horn for 2½ minutes. Thirty seconds should be enough, since pilot light shows circuit that tripped.—A.B.

ANSWER to H-16—I suggest removing the switch that is now in series with the horn and in its place use one of the ratchet timers similar to those used on gas and electric ranges which are spring driven and can be set for any desired time interval. When it is desired to stop the horn, the handle or knob on the timer is set for whatever time required to correct the fault. If enough time is not allowed and horn starts to blow again before work is completed it is only required to reset timer for additional time.

If timer is forgotten after fault is repaired no horn will result as the timer will close the horn circuit as soon as set time has elapsed. These

timers are normally open, but can be reconnected or a normally closed type may be available.

There are also a number of electrically driven timers on the market that will do the job, but would probably require a different source of current than the horn and would have to be wired so the timer motor current would be cut off by one of its own contacts except while timing—and holding the horn circuit open.

I believe the spring driven timer would be the most suitable. If timer contacts are not heavy enough to carry required horn current, a relay would be required.—E. E. M.

Can you ANSWER these QUESTIONS?

QUESTION U17—How can I convert the watt meter reading of a 3 phase motor with locked rotor into lbs. torque?—C.H.H.

QUESTION V17—We have recently had occasion to install a 2400 to 440 volt, three phase transformer bank in delta-delta, and were considerably concerned over the best method of grounding the secondary. There are, of course, three methods: ground one corner of the delta, ground the midpoint of one leg, or leave the system ungrounded. Can some reader advise the advantages and disadvantages of each?

In this case the code would not require grounding, but what would be the proper method of grounding a lower voltage secondary where grounding is required?—D.H.N.

QUESTION W17—What difference is there between a 32 watt fluorescent starter switch and a 40 watt fluorescent starter switch, since both can be used interchangeably?—H.S.

QUESTION X17—Some distance from the plant we have a 200,000 gallon concrete water storage tank with floatless level controls on the pumps. We would like to install an instrument in the plant to indicate tank level. Would it be possible to use an ammeter with a field rheostat operated by a float, this float to cut resistance out of a circuit and increase current flow with an increase in water level? Have any of your readers used such a scheme?—W.P.R.

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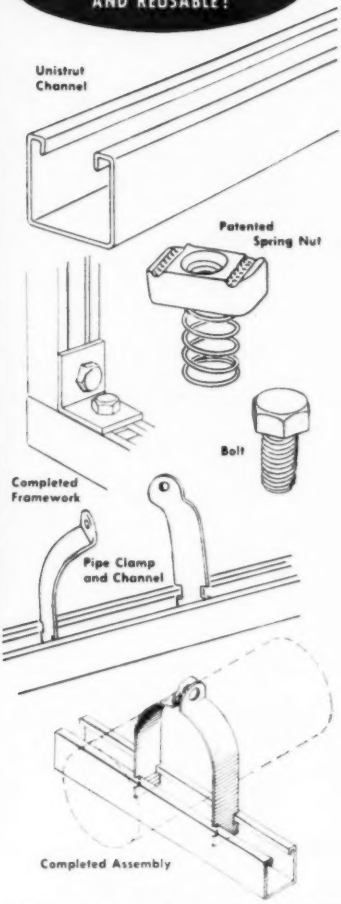

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and

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Rochester, N. Y.

Questions on the Code

Protection for Conductors

Q. *I am interested in obtaining your thoughts pertaining to protection for conductors used for the remote control of motors. For instance, a 25 horsepower 220 three phase 60 cycle induction motor has a full load current of about 64 amps and a locked rotor current Code Letter "B". This motor is to be started with an across the line starter. The Code will then permit 175 amp fuses in the supply line to the motor. Assume the following sequence of equipment, supply line to 200 ampere safety switch with 175 ampere fuses to magnetic across the line starter to motor; assume further that a remote control pushbutton station is to be used with the starter. If the wire to the pushbutton station was No. 14 AWG, would not I be violating the provisions of 4372 a. as 175 amperes is far more than 500% of the current carrying capacity of No. 14 wire?*

This matter bothers me somewhat because my catalogs do not list fuses for control circuits as standard equipment on large starters and I wonder if I shouldn't have such fuses on the starter in the situation described above.—G.W.

A. Inasmuch as the control circuit of a magnetically operated controller is usually in series with a magnet winding having sufficient resistance to limit the current in the circuit to a value much less than the safe carrying capacity of No. 14 wire, only a fault occurring between this winding and the point of supply for the circuit could result in any serious overload of the conductor. As practically all installations can be made with only a short section of wire between the source of supply and this winding wholly enclosed within the starting equipment cabinet itself, we actually have in most instances an installation somewhat comparable with a Class 2 control circuit as defined under Article 725 of the Code.

There are without question instances where this condition does not exist and where if the protective devices on the motor circuit are in excess of 500% of the carrying capacity of the control conductors used, some means of providing overcurrent protection for the control conductors must be applied. Such instances, however, are extremely rare with the result that I know of no controller manufacturer who provides cutout bases for such protective devices.

Then, in addition, there are instances in which the use of a controller having a protected circuit might actually introduce a serious hazard which would far outweigh the safety factor gained by the use of an overcurrent protective device in the control circuit. As an example, it might be mentioned that on a fire pump installation an overcurrent device on a control circuit would actually result in creating a hazard—G.R.

Free Conductor Length of Outlets

Q. *In Section 3006, is the length of the "free conductor" to be measured from the end of the BX sheath or from the front edge of the box?—W.E.R.*

A. It is my opinion that this rule intends to require the conductors to project 6 inches from the front edge of the box. If the rule only covered the distance from the BX connector there would be many cases, when switch or receptacle outlets are concerned, where there would be less than 2 inches of free conductor outside the front edge of the box. This would be particularly true when the rear K.O. holes of a 4 inch deep box were used. The intent of this rule is to provide the electrician with sufficient conductor to make a good connection.—B.A.McD.

Plug Fuses On 220 Volt Circuits

Q. *Plug fuses have a rating of 150 volts to ground. If used on 220 volt circuit or 150 volts or greater between phases, plug fuses are permitted if neutral is grounded. If an open circuit exists on system of over 150 volts to ground, the gap in the fuseholder between opposite polarities is smaller than is permitted in the N.E.C. Code. Please enlighten.—M.N.*

A. According to Section 2451 plug fuses of the Edison Base type are classified at not over 125 volts, 0-30 amps and they are so listed by the Underwriters Laboratories. According to Section 2403 plug fuses and fuseholders may be used on circuits exceeding 125 volts between conductors provided the system has a grounded neutral with no conductor operating at more than 150 volts to ground. This provision includes the 110-220 volt 3 wire system or the 120-208 volt 3 phase 4 wire system. According to the third sentence of your question which assumes a circuit of over 150 volts to ground, plug fuses could not be used on such a circuit. Section 92405 has a table which covers separation of parts of opposite polarity and also the minimum break distance. This table, however, only applies to link fuses and fuseholders and is not concerned with plug fuses. The construction of plug fuses and holders is covered by Sections 2451 to 2453 of the Code. A review of these requirements should show that plug fuses, for example, may be used on a 220 two wire circuit which is part of a 3 wire 220—110 volt system with the neutral grounded.—B.A.McD.

Type TW Wire

Q. *I recently installed a floodlight in a yard on a 2-inch pipe with Type TW insulated wire run through a ½-inch galvanized conduit underground to this 2-inch pipe standard. The conduit was made up as tight as practical with a pipe wrench, however, I did not use pipe joint cement at the couplings. A portion of this conduit was under a cement slab and because I could not dig up this portion, the inspector required that I replace the Type TW wire with lead covered wire in this underground conduit run.*

I was under the impression that TW wire was made to stand dampness or condensation which is usually found in underground conduit even if the joints were not sealed. I feel that the joints I made were water-tight. Is it

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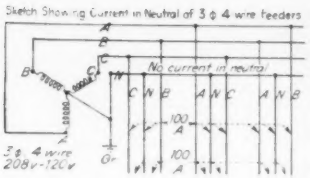
not possible to use Type TW wire in such underground runs?—O.M.T.

A. You are correct in your assumption that Type TW wire was made and approved for use in underground conduit runs. It is, however, possible that local rules and regulations may prescribe the type of insulation to be employed in an underground run in your area. The National Electrical Code accepts the use of Type TW runs in all underground raceway systems with the possible exception of those few where excessive temperatures might exist. As far as moisture is concerned, this type of insulation is approved for use or is subject to moisture. However, underground conduit runs should be so laid that pockets will not be formed where a conduit will fill completely with moisture. It is most essential in those areas where such underground runs are subject to freezing temperatures that proper drainage be provided inasmuch as a conduit filled with water if subject to freezing will actually place sufficient pressure on the insulation to often cause the circuit to fail. Sealing the joints with pipe compound will not stop the formation of water as this is caused principally by condensation brought about by temperature changes and not by direct seepage.—G.R.

Current on Neutral Conductor

Q. *I recently ran into an old installation that had been changed from dc to ac. The ac service is now 3 phase, 4 wire, wye, and the old 3 wire dc feeders were connected to two phases and the neutral of the new ac service. On testing the load on these 3 wire feeders I found considerable current on the ground wire, when with a balanced load you would expect to find very little current on the neutral. Kindly advise since this question has created quite an argument among the men on the job.—A.M.*

A. The fine print statement in note No. 5 following tables 1 and 2 of the N. E. Code tells us, a 3 wire circuit consisting of two phase wires and the neutral of a 4 wire, 3 phase system, that the so called neutral conductor is not a neutral conductor unless the 3 phase wires are part of the circuit. If the 3 wire feeders you mention above are connected to a 3 phase, 4 wire system and the load from each phase to the ground wire is 100 amperes, the ground wire also will carry 100 amperes. When the three phase wires are used and



we have a load of 100 amperes from each phase to ground, there will be no current flowing in the neutral ground wire. An explanation of this may be obtained from any text book covering the fundamentals of ac circuits. The sketch shown, however, may clarify the question you have raised. Under the conditions you have described there will be considerable current in the ground wire. In order to simplify the problem and still show how the current in the neutral varies, I have connected to a 3 phase 4 wire feeder, three subfeeders each consisting of 2 phase wires and the neutral and each sub having a 200 amp, 120 volt load. Reference to the sketch shows that the neutral of each subfeeder carries 100 amps which is explained by the fact that unless the three phases are part of the circuit the ground wire is not a neutral conductor. The sketch further clarifies the point by showing the neutral of the main feeder carries no current since the load is evenly divided over the three phases.—B.A.McD.

Pull Boxes

Q. *Is an LB a pull box? If not please explain. If an LB is a pull does Article 3708-A-2 forbid their use in conduit 1¼ inch and larger if No. 6 wire or larger is used? These larger LB's seem to pass inspection, please explain.—H.F.H.*

A. According to the Underwriters Laboratories' listing the LB is listed under outlet boxes and fittings. The U. L. listing of junction and pull boxes does not include the LB fitting. This appears to be confusing since we know that LB fittings in the smaller sizes are used as outlet boxes and fixtures or other devices are attached to them. In the larger sizes, however, they are used as pull boxes which facilitate pulling the wires in a run of conduit as for example a service riser. In view of the foregoing an LB is a pull box. Section 3708-A covering the minimum sizes of pull boxes where raceways larger than 1 inch and conductors No. 6 or larger is involved does not apply to these LB fittings. Section 3708-A-3 of the Code eliminates these fittings from the requirements.—B.A.McD.

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No. 1905, 1¼" offset hanger, 18". No. 1905-A, 25¼".
No. 1915, 1 11/16" offset hanger, 18". No. 1915-A, 25¼".
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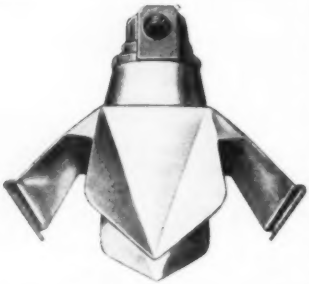

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Farm Wiring

Q. *In the wiring of buildings housing livestock, does the National Electrical Code require that the water piping system be interconnected with the neutral at the service supplying such buildings?*—R.F.B.

A. The present National Electrical Code contains very little in the way of regulations aimed directly toward safeguarding the wiring of farm properties. It is true that under Section 2581 the Code requires that a continuous metallic underground water piping system shall always be used as the grounding electrode where such piping system is available. However, the intent in this section refers entirely to the type of water distribution system which supplies a city, town or village and not to a private water distribution system which may not have sufficient electrical contact with the earth to provide a good ground. Furthermore, due to the susceptibility of livestock to electric currents, it has been found advantageous to isolate them from any possible current by means of insulating tubing inserted in pipe lines furnishing drinking fountains. Therefore, while it is possible the Code might require the use of a water piping system extending underground to a building housing livestock to be used as a neutral ground, it is strongly recommended by most persons well acquainted with the problem of wiring farm properties that no ground connection be made between the neutral and such water piping on buildings housing livestock. In fact, in many areas such practice is prohibited by the authorities having jurisdiction.—G.R.

Motor Protection

Q. *I am designing a new service to feed an existing load plus a used news press. The press consists of two units, each having a 75 hp, 230 volt, 3 phase wound rotor motor drive, plus a 7½ hp auxiliary drive. A two section controller is provided, with an open type knife disconnecting switch for each section, and overload relays for each 75 hp motor, and fuses for each 7½ hp motor. Both sections may start simultaneously. Inasmuch as there is no indication that the starters are approved for group installation, am I correct in specifying a motor-branch-circuit overcurrent device for each section, or could a single device be used? The remainder of the plant load requires a 400 amp. feeder for the advantages of flexibility and reliability,*

I am specifying a 275 amp. breaker for each section of the press and one for the general plant load. Ahead of these breakers I have specified an 800 amp. service entrance breaker. From an economic consideration in future installations, could I dispense with the 800 amp. service entrance breaker providing the other three breakers were located at the point of service entrance?—W.E.T.

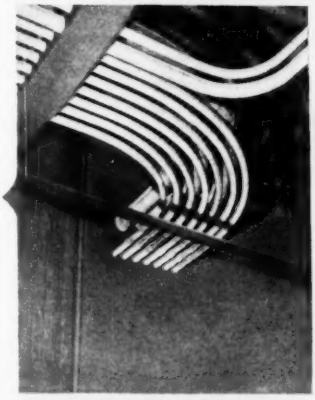
A. Section 4322 of the Code covers overcurrent protection for continuous duty motors. This Section requires that each of the 75 hp and 7.5 hp motors be separately protected. Section 4343 of the Code recognizes several motors on one branch circuit under certain conditions. Since some of these conditions involve the use of controllers and motor-running overcurrent devices which are approved for group installation, you could not apply this section to your problem as it is quite evident from the information given that neither the controller or starters comply with this requirement. It, therefore, follows that each of the four motors involved have its own motor branch circuit protection as well as separate motor overcurrent protection.

The 800 ampere main service breaker could be eliminated provided the three 275 A breakers were located at the point of the service entrance and, this is important, are approved as suitable for use as service equipment. The breakers must be manually operable with overcurrent protection in each ungrounded conductor, other requirements are covered by Sections 2351 and 2371 of the Code.—B.A.McD.

Switchboard

Q. *We have recently revamped the wiring in a millwork plant and in order to add additional equipment found it necessary to move the existing switch panel so the space behind the panel is now accessible only from one end. The wall back of the panel is a wall in which there are several piers or pilasters which protrude into the room about 5½ inches and there is some question as to whether or not we have provided adequate space between this wall and the back of the switchboard. The local inspector seems to feel there should be at least 30 inches between the pilaster and the back of the panel. Actually we have about 25 inches between the back of the panel and the pilaster and a little over 30 inches between the wall proper and the back of the panel. The consulting engineer who diagrammed the present location of this board*

for a fast, clean job... make smooth, accurate conduit bends like these in minutes with a Greenlee Hydraulic Bender



Look at these "tailor made", precise bends — just a few of the many made with a GREENLEE Bender at the Ralston Purina Plant in Bloomington, Illinois, by Kelso-Burnett Electric Co., Chicago. In commenting on GREENLEE performance, this contractor says, "Greenlee Benders have been used by us on projects in many sections of the country since the time of their appearance on the market. They have always produced satisfactory and economical results for us." You, too, can do the job better, faster . . . make great time and material savings with the versatile GREENLEE. It's one-man operated, compact, portable . . . makes neat, perfect bends in just a few minutes in rigid and thin-wall conduit or pipe up to 5", tubing, bus bars. Get free Bender Booklet today. Write Greenlee Tool Co., 1742 Columbia Avenue, Rockford, Illinois.

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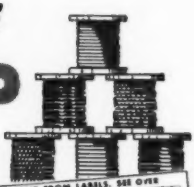
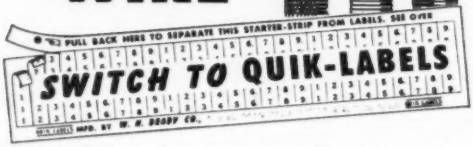
Hand Benders • Joist Borers • Cable Pullers • Knockout Tools • Auger Bits and Drills

IF YOU USE
COLORED
WIRE





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claimed it would comply with the Code and therefore we do not want to go to the expense of moving the board if it does comply with Code requirements. —R.C.G.

A. Section 3855 of the N. E. Code provides that where the space behind a board is accessible only from one end, it is necessary to add 6 inches to the minimum spacings shown in this section. If the board in question exceeds 42 inches in width, then it would be necessary that you provide a minimum of 30 inches of spacing between the wall and the board. In the fine print note following this section, you will find the following wording:

> "Reduction of clearances for short intervals by building columns behind the switchboard, or by equipment on a single panel in the switchboard, is permitted provided the clearances are not reduced below those required for a single panel board."

Therefore, inasmuch as this section would require only 24 inches between the equipment on the back of a panel and the wall on a single panelboard, your installation apparently complies with the Code as you have 25 inches or an extra inch clearance at this location. It is, of course, assumed that your measurements are from the equipment mounted on the back of the board and not from the back of the board itself.—G.R.

Correction

In the question and answer entitled "How Many Outlets on a Circuit", which appeared on page 111 in the December issue of *Electrical Construction and Maintenance*, an example was used to show how to figure the number of circuits required in a dwelling occupancy. This example, as it appeared, covered a floor area of 1200 square feet. This area is in error since it should have been 2500 square feet. Even though the computation indicates this was intended, we wish to eliminate any misunderstanding which might arise due to this error.—B.A.McD.

Size Fuse Back of Thermal Cutout

Q. *In installing several motors (over 1 hp) on one branch circuit, Section 4343 (4) refers to Section 4330. Should I infer that branch circuit fuses may be rated greater than four times the rating of the thermal cutout or relay protecting the smallest*

motor in the group, provided each starter is approved for group installation?—W.E.T.

A. You are correct in assuming in line with Section 4330 of the Code that when motor running overcurrent devices and motor controllers are approved for group installation the overcurrent protection back of them may be greater than four times the rating of the motor. Several manufacturers list such controllers with the Underwriters Laboratories. In all cases the controller is marked with the rating of the maximum fuse with which it may be used.—B.A.McD.

Service Equipment

Q. *We are replacing antiquated service and feeder runs in a rather large building and would like to make use of bare copper bus between the transformer vault and the building service equipment on the secondary side of the service. This service equipment will consist of five separate 200 ampere switches, each of which supplies light and power loads on one floor of a four story and basement building. Will the Code permit us to run open bus from the transformers in a separate transformer room to an adjacent area where the switches will be mounted and if so, will it be necessary to build an enclosure around these secondary switches? The voltage involved is 230 volts.*—M.M.

A. The Code would permit the use of open bus between the transformer secondaries and your service equipment for the building provided you comply with the requirements shown under Section 1113 of the N. E. Code. Here you will note that such live parts must be enclosed with some type of enclosure which will make them accessible only to qualified persons. This may be done by means of partitions with a locked door, or by a fenced enclosure with a locked gate, or by locating the equipment on a balcony or platform elevated 8 feet or more above the floor. Furthermore, if the transformers are of the oil-filled type, it will be necessary that you provide a proper means of bringing the open bus through the transformer vault wall so no opening will be left to make possible the communication of fire or smoke through this opening.

As you neglected to advise of the primary voltage entering this transformer vault, it is necessary that we call to your attention the necessity of providing this same precaution for

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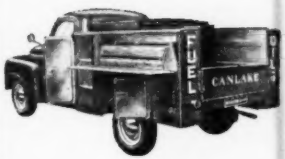

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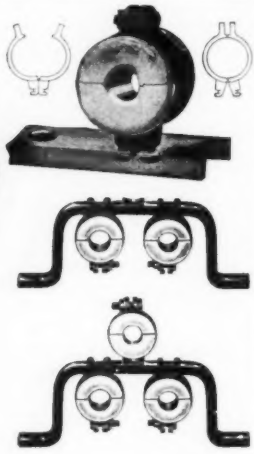

Efficiency Nested Conductor Racks are simple, compact and are scientifically designed to carry conductors equidistant from center to center. One bolt supports the bushing and clamps the bushing support to the frame. Available in 2-3-4-5 and 6 bushing racks.

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the bus leaving the vault if the primary voltage is in excess of 15,000 volts even though Askarel transformers are used. Manufacturers of bus equipment have available a type of bulkhead of insulating material through which the bus bars can be passed so no opening will be left in the wall where the bus leaves this room.—G.R.

Number of Conductors In a Box

Q. *In order to satisfy Code Sections 3709 a and b may extension rings be used to obtain additional area?—A.McD.*

A. Official interpretation No. 354 issued last May recognizes such procedure. I believe you will find, however, that many inspectors will insist that the proper box size be used and that the permission to use extension rings be limited to jobs where unintentional errors are made or on old jobs where additions involve this requirement.—*B.A.McD.*

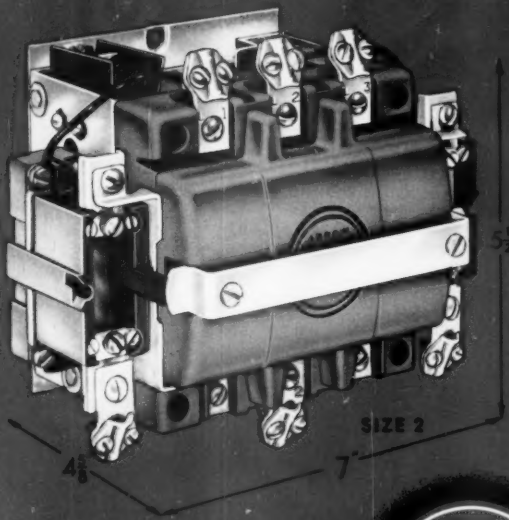
Ground Circuit Impedance

Q. *Please explain what is meant by "and shall have impedance sufficiently low to limit the potential above ground". Code Article 2551.—J.Y.M.*

A. The impedance of an ac circuit is similar to the resistance of a dc circuit. The characteristics of alternating current not only involve the resistance of a circuit, they also involve the reactance of the circuit and the vector sum of the resistance and the reactance gives us the impedance of the circuit.

According to Ohms law the relation between voltage current and resistance in a dc circuit is expressed by the formula $E = I R$. On an ac circuit the resistance is replaced by the impedance and the formula becomes $E = I Z$, with Z representing the impedance. Application of this formula shows that in the case of a fault on an ac circuit the greater the impedance the voltage above ground will also be greater and the current flowing in the circuit will be correspondingly smaller. It, therefore, follows that unless the impedance is low, the current flowing in the fault circuit will not be large enough to operate the overcurrent device in the circuit and the voltage above ground of the wiring system will be raised to a dangerous degree.—B.A.McD.

BRING OUT **BUILT-IN PERFORMANCE** OF MOTORS AND MACHINERY



Applied to the B. M. Root Company combination multiple sawing and wood boring machine Style CXH, Arrow-Hart Type "RA" Magnetic Starters, in conjunction with the A-H Push-Pull-Selector and Type N Disconnect Switches, afford simplified and dependable control in a minimum of operating space. The same combination of A-H Type "RA" starters with the A-H Disconnect Switch permits a small, unusually compact panel layout.

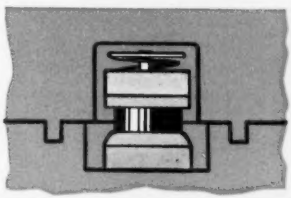
NEW TYPE "RA" MAGNETIC STARTERS

ARROW AH HART

JUST 1/2 THE SPACE *PLUS* FULL PROTECTION

HIGH ARC RESISTANCE

Arrow-Hart "RA" Magnetic Starters and Contactors feature a new thermosetting molding compound in the base and hood. This alkyd, with an extremely high resistance to tracking, exceeds the arc resistance of the next best material by more than 50%. It does not support combustion. The tongue and groove design pictured at right provides individual arcing chambers around each contact. This full protection is only one of the many features that add up to outstanding performance in Arrow-Hart "RA" Magnetic Starters. For more of the story, see next page.



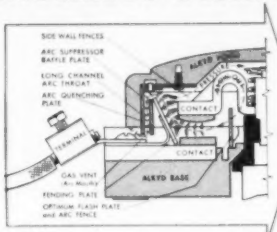
AVAILABLE IN A FULL LINE -- Sizes 0, 1, 2, 3, and 4.

THE ARROW-HART & HEGEMAN ELECTRIC COMPANY, HARTFORD, CONN., U. S. A.

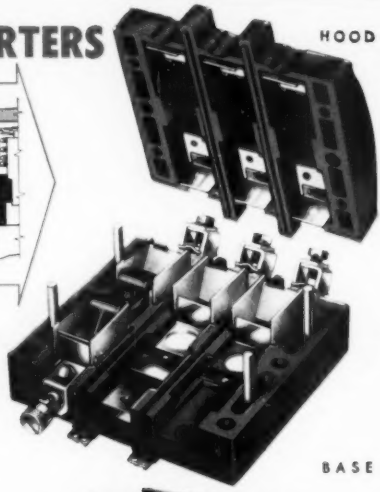
ARROW AH HART

TYPE "RA" MAGNETIC STARTERS

MAXIMUM SAFETY

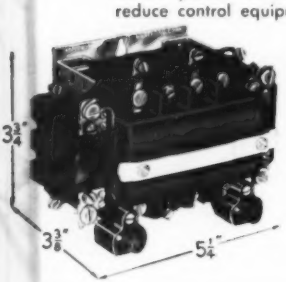


All A-H Magnetic Starters and Contactors are designed for maximum safety. The view at right shows how special protection is provided for the Size 4 (50 to 100 H.P.). This unit is designed so that the arc follows a controlled path, across and between the quenching and baffle plates. High heat-proof chutes enclose each contact. Contacts are shaped to produce a magnetic "blow-out" field within the arc fence. This field forces the arc in the correct direction for extinction.



MORE FEATURES--IN ½ THE SPACE

In A-H starters and contactors an exclusive new "RA" balanced mechanism multiplies leverage and increases contact pressure. It is this same mechanism that accounts for the revolutionary small size of Arrow-Hart starters. Other features are: guided parallel closures to insure contact alignment; new, bigger contacts; improved magnet and coil; plenty of wiring room; and many others. Most important of all — designers save valuable control space, reduce control equipment cavities, and cut material costs.



SIZE 0

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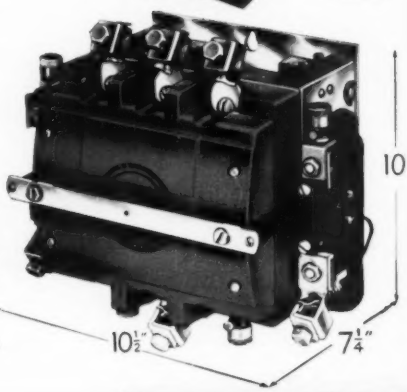
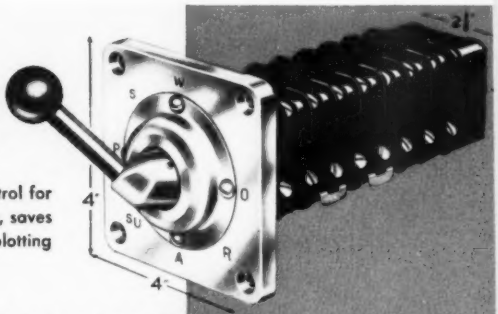
Arrow-Hart Type "RA" Magnetic Starters and Contactors are available in a full line — Sizes 0, 1, 2, 3, and 4. For full particulars, write for Form G-7005.



SIZE 4

New PUSH-PULL SELECTOR SWITCH



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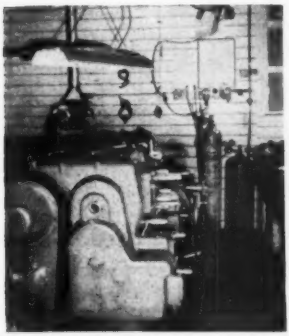
Motor Shops

EXHAUST HOOD, riding with the torch rack and connected through a flexible sleeve to the wall-mounted exhaust fan, draws fumes away from the working area of the metal spraying lathe in the shop of the Reed Electric Company of Portland,



SWING BOOM supports 2-lamp fluorescent industrial lighting fixture above lathe, making it possible to position light.

Adjustable Light and Exhaust Hood

Metal spraying of shafts has a two-fold purpose in the shop of the Reed Electric Company of Portland, Oregon, for it conserves the shaft by replacing worn metal and, by building scored shafts back to their original diameters, it permits the use of standard sized bearings.

A 3-hose connection at the bench torch permits the precise mixing of oxygen, air and acetylene for the flame desired, while a movable exhaust intake can be adjusted for pulling fumes away from the work on the lathe. And, so that high-intensity lighting will be available for all lathe positions, an industrial 2-lamp fluorescent fixture is supported over the lathe by means of a swing boom.

Paper Trimmer Used As Insulation Cutter

An ordinary paper hanger's trimmer is used as an insulation cutter in the motor repair division of the Clarence W. Silver Company in Salt Lake City, Utah. The 6-foot guide with its metal edge is mounted to the work surface 4½ inches back from the edge of the table; held securely in position by a C-clamp at each end.

Rolls of insulating paper are mounted on spindles at the base of the 37-inch high table. After the mechanic slides the paper between the guide and table surface, he measures the width of cut with a scale. Then he pulls or pushes the cutting attachment with its rotary knives over the paper and the cut is made. When large quantities of insulation of the same width must be cut, stop-blocks can be used to position the paper instead of measuring each cut with a scale.

Mechanics at the Silver shop find this device very effective and have acquired considerable skill at cutting insulation with the trimmer.

PAPER HANGER'S TRIMMER cuts roll insulating paper at the Clarence W. Silver Co. shop in Salt Lake City. Unit is mounted to table by a C-clamp at each end.

ROTARY KNIFE attachment cuts paper held between guide and table surface.

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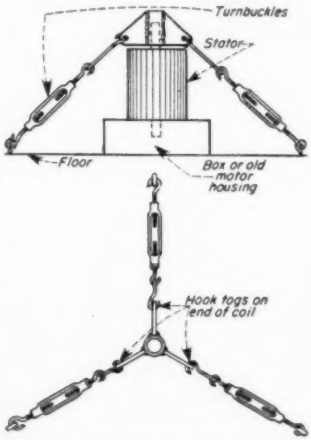
Many methods are used in stripping stator coils and each does the job but with varying amounts of physical labor and time.

A quick method with no manual effort has been perfected by Commercial Electric Company of Savannah, Ga., by the use of an electric hoist and a shop-made tongs or pulling mechanism. In fact the coils can be stripped from a 5 hp or larger motor in less time than is required to read how it is accomplished.

The tongs were cut from ½ by 2-inch tempered sheet steel and bolted together, the points cut at an angle to firmly grip the coil. Three turnbuckles are attached to the floor and to the

TONGS are from tempered steel stock with points for gripping coils.



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It's a better installation, too. The integral breaker gives three-way protection . . . something no combination of transformer and external protectors can do. Because the breaker is located inside the transformer case, it is actuated by (1) overcurrent, (2) temperature, or (3) by both in combination. Greater safety for equipment on the line! Better protection for the installation!

Available in ratings from 100 to 15 kva (Type AVRB) and 10 to 3 kva (Type AJRB). Other dry-type transformers without breakers are available.

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SIMPLIFIES — Replacement of defective lamp automatically recycles starter circuit. No buttons to push — no replacement of starter.

REDUCES COST — Magno-Tronic starters provided exact timing of electrode heating, preventing excessive loss of emission material, thus assuring maximum possible lamp life.

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SP-15-20 For use with 15 or 20 watt lamps.

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P.S. When you order your next supply of BULL DOG Friction Tape, be sure to order a plentiful amount of BULL DOG Splicing Compound, too . . . and always keep enough on hand. It's tops for high resistance to electricity and water . . . self-vulcanizing into a solid, watertight joint.

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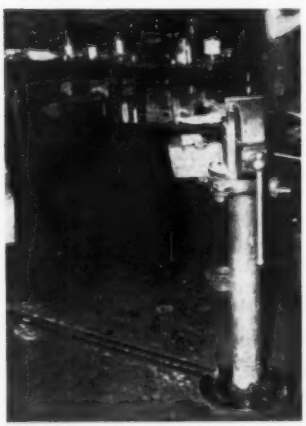
stator housing to hold it in place. One end of the coils is cut off at the laminations and then placed as shown in the picture. The tongs are attached to the coils and raised by the overhead electric hoist and out jump the coil.

Armatures can be stripped in the same easy manner. A section of pipe is fitted with three flanges and is held over the top of the armature by the three turnbuckles. One end of the coils is cut off at the laminations and the tongs and hoist used to strip the coils in the same manner as from the stator.

These devices were perfected by Fred S. Stephens after searching for a less laborious method of coil stripping.

Floor Channel Holds Sliding Vise

In the shop of the Reed Electric Company, Portland, Oregon, it is often convenient to have a heavy-duty metal vise in the center of open floor spaces, removed from work benches and so located that it can be used in any position. This convenience is supplied by mounting such a vise on a heavy pedestal and providing channels in the shop floor to which the pedestal base can be bolted. The pedestal can be moved along the channels to any desired position and the bolts tightened when the vise is in the most useful area. For added convenience, the vise itself can be rotated and tightened with the customary lock incorporated in the two-plate base. This provides complete freedom of movement for operators in the Reed shop.



FLOOR CHANNELS make it possible to slide vise pedestal to any desired position. Base is secured in position by bolts, and vise head swivels for added convenience.

HYDRAULIC DOLLY-TABLE is effective labor saver at Myers Electric Company in Salt Lake City. Unit was fashioned from old barber chair base; can be raised, lowered, rotated and moved about the shop.

Hydraulic Dolly Also Work Table

The base of an old barber chair is the heart of a hydraulic dolly and work table used at the Myers Electric Company, Salt Lake City motor repair shop. To the bottom of the base unit were mounted four heavy industrial casters. To the top, a 28-inch square work surface was built up with two layers of 1½-in. by 5½-in. wood planks. At lowest position the top is 28½ inches above floor level. The hydraulic mechanism of the base, operated by a foot pedal, raises the table another 10 inches.

Mechanics at the Myers shop find many uses for the dolly-table. They raise the table to truck bed height to unload and load equipment; raise it to bench height to transfer work to benches; and even use it as a work bench. With the table top rotating 360 degrees, a mechanic can work on all parts of the equipment without changing his position.

PROMINENT IDEA MEN in the electrical equipment service department of the Clarence W. Silver Company, Salt Lake City, Utah, are Lynn Silver (left) assistant manager; and Glenn Reynolds, shop foreman.

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Industrial Electrification

Modernize High Voltage AC Motor Controllers

How air-break contactors can reduce maintenance problems on high voltage ac motor controllers. A comparative discussion of air-break and oil-immersed types.

By T. Bellinger
Engineer, Control Section
Allis-Chalmers Mfg. Co.
Milwaukee, Wisconsin

WITHIN the past few years, high voltage ac air-break contactors have been developed for use as high voltage motor controllers. While these new contactors are designed to eliminate serious maintenance problems, they by no means obsolete the conventional oil-immersed type. Each has its definite place in the industrial control picture.

This discussion will present general information about high voltage contactors; important features of and a comparison between the oil-immersed and air-break types; also factors to be considered when replacing the oil-immersed type in existing control equipment.

Contactors are power switches that close their contacts when a solenoid operator is energized and open their contacts when the solenoid is de-energized. Contact operation may take place in air (air-break type) or under oil (oil immersed type). Both types are widely used for control of motors, welders, transformers, hoists, electromagnets or any application where repetitive starting and stopping is required. The following discussion will be limited to motor control applications.

High-voltage ac contactors are suitable for use with all types of ac motors: squirrel cage induction; wound rotor induction; synchronous; and others of any rating that fall within the contactor rating limits as listed by the "NEMA Standards for Industrial Control." These ratings are 2,500 and 5,000 volts, and eight hour current ratings of 100, 200, and 400 amperes. The contactors must be capable of interrupting 10 times normal motor current and must withstand 15 times normal motor current for a period of one second.

High voltage ac contactors must not be confused with high voltage circuit breakers. The two devices cannot be used interchangeably except for certain specific applications of control equipment. Circuit breakers are capable of interrupting short circuit currents and have voltage ratings that extend well above the maximum 5,000 volt rating of contactors. Due to the large masses of the contact making mechanisms and delicate actuating and latching devices, circuit breakers are not capable of numerous repeated operations as are contactors.

Oil-Immersed Contactors

A high voltage oil-immersed contactor consists of a contact and operating mechanism suspended in a container or tank filled with a suitable switch oil to a level well over the arcing portions of the contact assemblies. The contactor can be constructed very compactly because the insulating ability of oil is greater than that of air. Minimum spacing for a 5,000-volt rating as seen in Table I is 1½ inches in oil as compared to 3½ inches in air. Because of the insulating medium, these contactors can be conveniently constructed for 3/3, 3/5 and, of course, the widely used 3-pole arrangements. Table II shows that the high voltage ac oil-immersed contactors are available from most manufacturers for maximum motor ratings of 700 hp., 2,500 and 4,160 volts at 80% power factor.

Oil-immersed contactors are particularly suitable for operation in semi-hazardous locations where inflammable vapors or gases are present in the air in sufficient quantities to produce explosions. Such applications depend upon the Underwriter's approval of the contactor and the local regulations and codes. For extremely dusty and corrosive atmospheres, the oil-immersed contactor is a natural. It is used ex-

Rating in Volts	Minimum Clearance in Inches			
	Through		Across Clean Dry Surface	
	Air	Oil	Air	Oil
51–150	⅛*	⅛*	¼	¼
151–300	¼	¼	⅜	⅜
301–600	⅜	⅜	½	½
601–2500	1	¾	2	1
2501–5000	2	1½	3½	2
5001–7500	3½	2	5	3

Note: Distance (*) between wiring terminals cannot be less than ¼-inch.

TABLE I — MINIMUM CLEARANCES from "NEMA Standards for Industrial Control" can be used as a guide when modernizing existing control equipment. These standards are followed by manufacturers.

FIG. 1—Oil-immersed 3-pole contactor on high voltage ac motor controller. Rear view of unit shows contactor oil tank lowered.

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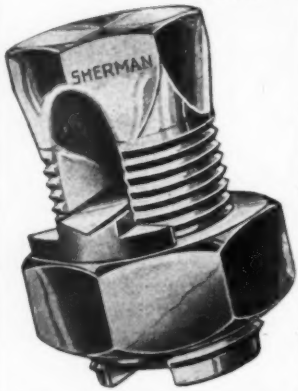

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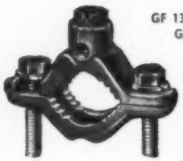

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Line Voltage	Motor Rating Horsepower 100% PF	Motor Rating Horsepower 80% PF	Reduced Voltage Starting Oil Immersed Contactor	Reduced Voltage Starting Air-Break Contactor	Full Voltage Starting Oil Immersed Contactor	Full Voltage Starting Air-Break Contactor
2200–2300	——	700	X	X	X	X
"	800	....	X	X	X	X
"	....	1500	....	X	....	X
"	1750	....	....	X	....	X
4000–4600	....	700	X	....	X	....
"	900	....	....	....	X	....
"	....	1250	....	X	....	X
"	1500	....	....	X	....	X
"	....	2500	....	X	....	X
"	3000	....	....	X	....	X

TABLE II—MAXIMUM MOTOR RATINGS of high voltage ac contactors. "X" indicates maximum contactor capacities listed by most manufacturers of such devices.

Method of Starting	*Starting Current Drawn From the Line as a Percentage of Full Load Current	Starting Torque as a Percentage of Full Load Torque
Connecting Motor Directly to the Line-Full Potential	470	160
Auto Transformer 80% Tap	335	105
Resistor or Reactor Starter to Give 80% Applied Voltage	375	105
Auto Transformer 65% Tap	225	67
Resistor or Reactor Starter to Give 65% Applied Voltage	305	67
Auto Transformer 50% Tap	140	43
Resistor or Reactor Starter to Give 50% Applied Voltage	233	43

Note: Starting current values (*) do not include the magnetizing currents of the auto-transformers or reactors.

TABLE III—CURRENT-TORQUE CHARACTERISTICS for a typical 3-phase, squirrel-cage induction motor under different starting methods.

tensively in the petroleum, paper, fertilizer, cement, and textile industries.

These contactors are usually supported from panels or frameworks either in enclosures or open type structures. They must be mounted high enough to permit lowering of the oil tanks for servicing the contactors. Since this is a dead space that must be kept clear of other devices, it adds to the size of the frame enclosure for the controller unit. For routine inspections and servicing of the contactors, the tanks must first be removed —a time-consuming operation that frequently is objectionable.

The oil in the tank also requires maintenance. Arcs produced by power-circuit interruptions cause free carbon and gases to be formed in the oil. Switch gases seep out of vents provided, but the carbon remains in suspension or settles to the bottom of the tank. The oil also takes up moisture from the atmosphere. Excessive amounts of free carbon and moisture in the oil greatly impair the insulating quality of the oil and eventually it must be replaced or reconditioned.

Although contactor operation under oil is required for some applications, the presence of oil in a contactor or other device is considered a fire hazard. Such equipment is prohibited by many insurance and safety codes. The precautions that must be executed in the storage and handling of oils are familiar to all plant operating personnel.

Air-Break Contactors

High voltage ac air-break contactors are constructed similar to oil-immersed contactors but operate in air. Most designs incorporate magnetic blow-out coils and arc chutes or chambers that aid in extinguishing the arcs. These chambers usually are required, with

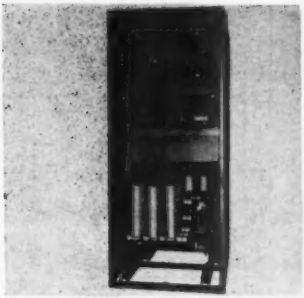

FIG. 2—Two rotating shaft type 3-pole, air-break contactors mounted back-to-back form reversing controller for a 300-hp., high voltage ac motor. Back of cubicle is open to show contactors.

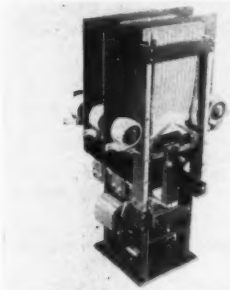

FIG. 3—New type high voltage air-break contactor has vertical make and break action. One half of arc chute in foreground has been removed to show contact action; simple inspection features.

compactness being sacrificed, to produce contactors suitable for severe starting service and heavy loads.

One common type of high voltage air contactor is the rotating-shaft design. It is "single-break" and similar to low voltage ac contactors except for much greater spacings. The rotating-shaft type is usually wider than oil-immersed contactors having the same number of poles but does not require as much space for height. Enclosures or open frames are suitable for contactor mounting. For reduced voltage starting or reversing service, two or more air-break contactors are necessary.

A more recent development in high voltage ac air-break contactors is the pedestal type. This design features a "double-break" contact arrangement and a dual blow-out circuit together with a special arc chute that permits an extremely compact assembly. The device is floor mounted; requires no additional support; and can be readily installed in existing control units.

The most important feature of high voltage ac air contactors is the long contactor life that can be obtained with

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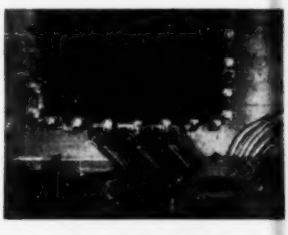

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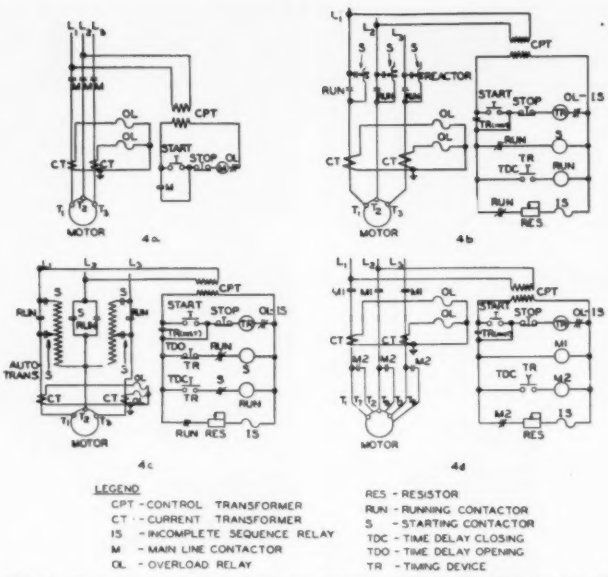

FIG. 4—Typical circuits for squirrel-cage induction motor controllers for (a) full voltage; (b) primary reactor reduced-voltage; (c) auto-transformer reduced-voltage; and (d) part-winding starting.

a surprisingly small amount of actual maintenance. On load interrupting, the magnetic blow-outs instantly draw the arcs away from the contact surfaces up into the arc chutes where the arcs are quickly cooled and extinguished. This prevents burning and pitting of the contact surfaces and greatly prolongs the life of the contact tips. Low inertia construction of the moving mechanisms minimizes destructive contact bouncing and mechanical shock or pounding. This makes the air-break contactor an excellent device for starting services requiring rapid, repetitive operation. As for all equipment, routine inspections are essential. These can be made quickly and conveniently by merely raising the arc chutes. All parts subject to wear and deterioration are accessible for replacement when repairs are necessary.

The pedestal type of air-break contactors has additional maintenance advantages in that the design has eliminated several items that are subject to wear. The magnet and moving contacts operate in a vertical-straight line motion that eliminates the need for rotating shafts, bearings, and flexible leads. The contact action together with double-break contacts lessens usual contact wear.

Maintenance Cost Comparison

That air-break contactors give longer trouble free service and are particularly suitable for repetitive duty is illustrated by the following case study.

An operating maintenance check was made by a manufacturer who had several oil-immersed contactor type controllers in his plant. At times, the contactors operated as often as once each minute and were in use 24 hours a day controlling large 2,300-volt motors. The units were shut down every third week for maintenance and servicing. Arcing tips, contact plates, and insulating oil had to be replaced in this 21-day period. Maintenance cost ran about $1,000 per year per contactor.

An air-break contactor was installed temporarily in place of the oil-immersed contactor with the severest duty cycle. It operated under these conditions for more than six months giving satisfactory service without any major difficulties. A check after 156,000 operations showed no perceptible wear on the contactors. This manufacturer is now in the process of replacing oil-immersed contactors with air-break contactors. One of these new modernization units is shown in Figure 5.

Installation in Existing Controllers

Many users of high voltage controllers and motors have old installations that are capable of providing months and years of satisfactory service. Replacement of their oil-immersed type controllers with complete new air-break type controllers would be ex-

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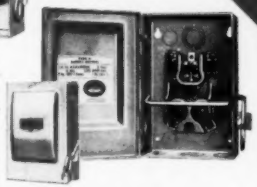

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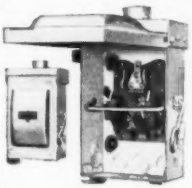

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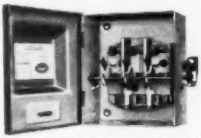

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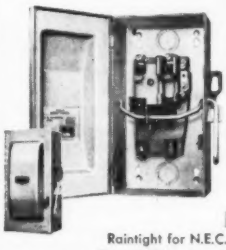

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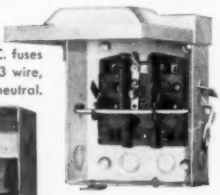

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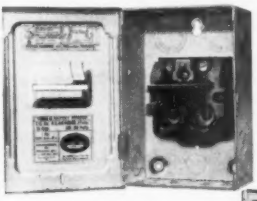

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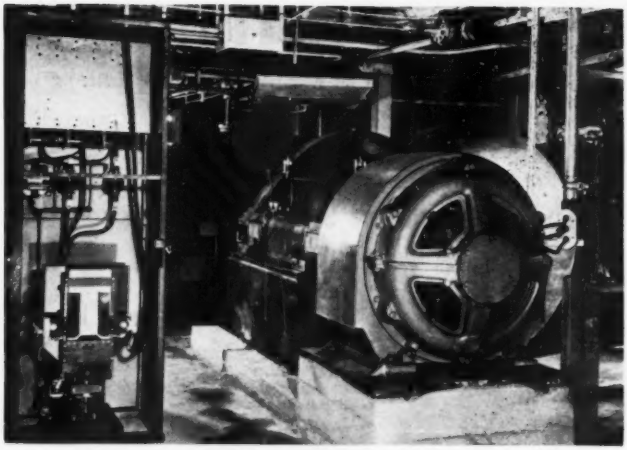

FIG. 5—Modernized controller using air-break contactors on a tough repetitive operation. It starts and stops a high pressure pump drive once a minute.

pensive and impractical. For these users, up to date, efficient, and convenient control units may be had by *replacing the present high voltage ac oil-immersed contactors with high voltage ac air-break contactors.*

When high voltage contactor replacement in existing control units is under consideration, here are several questions that should be studied first.

1. *Should present oil-immersed contactors be replaced with high voltage air-break contactors?*

Installation of new air-break contactors is advisable if maintenance time and expense for the oil-immersed contactor justifies the new equipment expenditures. Decisions must be based on operating-service records for each individual installation. If insurance rates are higher or plant safety is periled because of the use of oil filled devices, justification for replacing the oil-immersed contactors is usually certain. In general, air contactors cost about twice as much as oil contactors of similar rating. This represents about 25% of the total cost of a complete new controller.

2. *What motor sizes are covered with available air break contactor ratings?*

Table II shows the maximum 80% and 100% power factor motor ratings that can be handled by available contactors. These ratings at 80% PF are 1,500 hp. at 2,200-2,300 volts and 3,500 hp. at 4,000-4,600 volts.

3. *What locations are suitable for air-break contactors?*

The contactors are suitable for all general applications. Exceptions are extremely dusty and corrosive atmospheres or hazardous locations.

4. *Will air-break contactors be suitable for all motor starting circuits?*

For across-the-line starting—the air-break contactor can replace the oil-immersed contactor, usually without any alterations in the primary or control wiring. Fig. 4a shows a typical schematic diagram of a line starter with the line contactor operated from a control transformer.

In reduced-voltage controllers—primary reactors and auto-transformers are the usual voltage reducing means. If a three-leg primary reactor is used in the present controller, a three-pole double throw oil-immersed contactor will usually be used. Two three-pole, single-throw, air-break contactors must be employed in place of the single 3/3-pole oil-immersed contactor. Some minor circuit reconnections will be required, but the basic circuit for typical primary reactor reduced-voltage starting will be unchanged and similar to that shown in Fig. 4b.

The most common form of auto-transformer reduced-voltage starting is the two-leg auto-transformer and 3/5-pole oil-immersed contactor combination as shown in Fig. 4c. Such a method would require three air-break contactors. A reactor could be substituted for the auto-transformer and only two air-break contactors would be required as in circuit 4b. Using three air-break contactors would be expensive and impracticable. Substituting a reactor for the auto-transformer would be impractical in most cases unless a suitable reactor is already available.

Another means of reducing the motor starting current is through the use of a part-winding motor. Such motors have terminals of their parallel windings brought out and each winding is connected to the line in sequence until all are in parallel across

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the line. The most common type has two parallel windings which are connected to the line through a 3/3-pole oil-immersed contactor similar to the arrangement shown in Fig. 4d. Here again, two three-pole, air-break contactors would be required to replace the one 3/3-pole oil-immersed contactor. Only minor circuit changes would be required in making the substitution.

When air-break contactors are being installed in existing controllers, *it may be possible to change the type of starting.* That is, a reduced-voltage controller could be made into an across-the-line unit or the across-the-line unit could be changed to a reversing or to a reduced-voltage type of controller. Of course, such changes would require new control circuit schemes and in some cases, additional auxiliary devices.

5. *What mounting space is required for high voltage air-break contactors?*

If available mounting space is no less than 34 inches in width, the majority of 3-pole air-break contactors now being manufactured can be mounted readily. When air-break contactors are being mounted in the space originally occupied by an oil-immersed contactor sufficient height is almost certain. The clearance formerly required for lowering the oil tank together with the height of the oil-immersed contactor itself usually requires a mounting height greater than the highest air-break contactor.

When two contactors are necessary as for reduced voltage, part-winding, or reversing starters, the units can be mounted side-by-side, back-to-back or one above the other. Specific combination arrangements between contactors are required for dynamic braking, reversing, or any other types of starters that require mechanical interlocks between the contactors. For such special installations, the required information and plan drawings will be supplied by the manufacturer.

Air-break contactors, being normally floor mounted, are convenient for installing in existing control units. They are self-supporting and require no drilling or fastening to the uprights of the original oil-immersed contactor. Contactors can be located for convenience, away from the original units if desired. The floor mounting may also provide proper clearance and prevent interference with other devices on the control unit. Sufficient clearance must be allowed for cables and to lift the arc chutes for maintenance. The clearances in Table I are mandatory in the manufacture of electrical devices. These values can be used as a guide when making installations, but only in the absence of local codes and standards. *Before making any installation*

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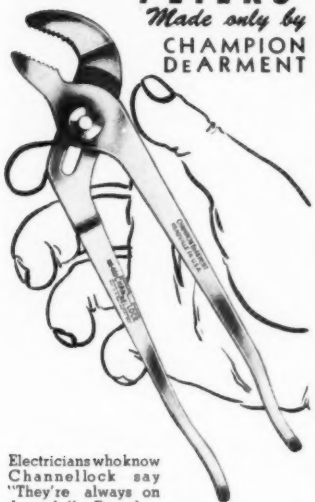

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always obtain certified drawings and installation information from the contactor manufacturer.

6. Can air-break contactors replace oil circuit breakers for motor starting use?

If the oil circuit breaker is being used as a high voltage motor-starting switch and *not for short-circuit protection*, an air-break contactor may be used, provided the motor size is within the rating of the contactor. Such a change would require a considerable revision of the control circuit and should first be referred to the manufacturer for recommendation.

7. Can high voltage air-break contactors be used with current limiting fuses, resistors, or reactors?

The contactors can be applied with any current limiting device if the contactor need not interrupt more than 10 times the normal motor current. Quite often the use of resistors and reactors to limit fault currents requires a much greater interrupting capacity. Such applications should be carefully studied before replacing the original switches.

Except for a few operating condition limitations, high-voltage air-break contactors are more desirable than high voltage oil-immersed contactors for most motor controller applications where highly repetitive and heavy starting duties are required. Air-break contactors offer advantages of longer contactor life, less maintenance, and are less hazardous. On the other hand, they are less compact and less versatile than oil-immersed contactors, being available only in three-pole, single-throw models. Air-break contactors can conveniently replace existing oil-immersed contactors for across-the-line, primary-reactor, reduced-voltage, line-reversing, and part-winding motor starting duties. Replacement of oil-immersed contactors in auto-transformer reduced-voltage type motor controllers is expensive and in most cases impractical.

SHOP FOREMAN W. G. Anderson has direct charge of repair activities in the motor service department of Wazee Electric Company, Denver, Colorado.

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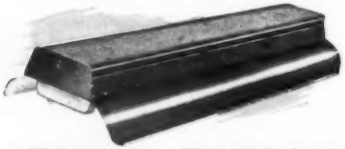

IUO-248—2-light 48-w. open IUP-248—2-light 48-w. closed end
IUO-348—3-light 48-w. open IUP-348—3-light 48-w. closed end
IUO-2-108—2-light 108-w. open IUP-2-108—2-light 108-w. closed end

Durable and strongly built fixtures, neat in appearance. All-steel housing, channel and reflectors. On continuous run wireway installations 2-light sections may be grouped with 3-light or blank sections. One-piece channel for twin 40-watt sections (8' length) or 100-watt sections (10' length).

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ZUO-248—2-light 48-w. open ZIU-248—2-light 48-w. closed end
ZUO-348—3-light 48-w. open ZIU-348—3-light 48-w. closed end

Corrugation incorporates unusual strength and rigidity into units. No warping, twisting or sagging! All-steel housing, reflectors, deep drawn channel. 2-light units can be easily converted to 3-light whenever desired. For individual or continuous run wireway installation

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NHI-268—2-light 72" NHI-288—2-light 96"
NHI-368—3-light 72" NHI-388—3-light 96"
NHI-468—4-light 72" NHI-488—4-light 96"

These heavy-duty Slimline fixtures bring streamlined styling to industrial lighting and provide exceptionally high light intensity. All-steel channel and reflectors. Designed primarily for continuous run wireway installations. Instant-start operation in choice of 120, 200, 300 or 425 ma. Multi-bulb units for up to 10 lamps available on special order.

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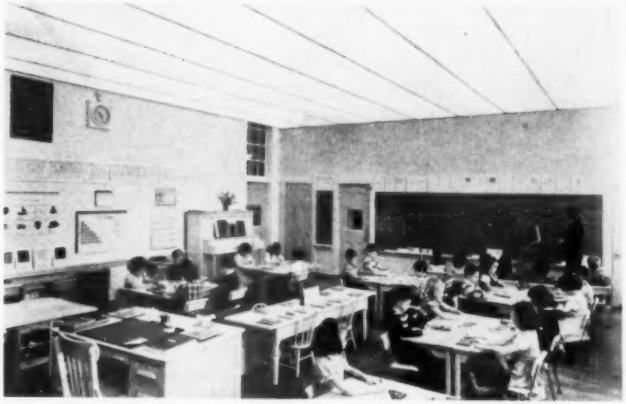

LUMINOUS CEILING in Hyde School is formed by corrugated plastic sheets supported by inverted T-bars. Slimline lamps positioned 2-feet above the plastic provide diffuse illumination varying between 67 and 40 footcandles to working surfaces in the room.

Translucent Plastic Forms Luminous Ceiling

A luminous ceiling consisting of thin (0.007 inch), light (1 oz. per sq. ft.), corrugated, translucent plastic sheeting is installed in the First Grade classroom of the Hyde School in Newton, Massachusetts. Developed with the cooperation of Professors Moon and Spencer of M.I.T. and Brown Universities, the new plastic provides a medium for inexpensively reducing glare, eliminating shadows, shielding light sources and diffusing light.

Suspension of the ceiling is by means of inverted T-bars, with the plastic sheeting resting on the metal flanges. The corrugated construction provides sufficient rigidity for a 36-inch wide section, but it is recommended that the sheets be occasionally inverted to prevent the formation of a permanent deflection. Such deformation, however, is so slight that it is not perceptible to the normal observer. This rigidity eliminates the necessity for intermediate cross frames and, since the material can be purchased in lengths for any desired span, sections between the T-bars can run from wall to wall without a break in the expanse of luminosity.

Relamping is accomplished by rolling the plastic sheets along the supporting frames, and washing of the translucent plastic is accomplished by immersing the rolled sections in a 1% detergent solution. After washing, sheets are unrolled in their original position and allowed to dry in place.

Installed in accordance with Perry-Moon recommendations, the Hyde School ceiling is illuminated by T-12 96-inch 4500-degree white G. E. Slimline lamps at a socket voltage of 110 volts. The plastic ceiling is suspended 10.5-feet above the 33-by-24.5-foot floor area, and 2-feet beneath the lamps. In all, 28 lamps are installed to provide a maximum of 67 footcandles in the center of the room, a minimum of 40 in the interior corners and 35 horizontal footcandles on walls.

The color of walls is a matt cream having a reflection factor of 76 percent. Desks are natural wood.

Combination Lighting Boosts Carpet Sales

The Zandt Carpet Company's 120-by-70-foot showroom in Hollywood, California, displays merchandise under three types of lighting: natural daylight, fluorescent and incandescent. Recessed into the 16-foot high acoustically-tiled ceiling, special 6-by-6-foot eggcrate-louvered fluorescent squares, manufactured by Light Control, are installed on 16-foot centers. In all, there are 23 such units in the show area. Recessed 150-watt R40 incandescent lamps are mounted at each corner of these square units, positioned 1-foot from the edges. An average of 25 footcandles is delivered to the carpet display racks, with a light load of 4.1 watts per sq. ft. (1.8 fluorescent, 2.3 incandescent). In addition, natural light is admitted through the 8-foot high windows. Since carpets are to be seen under all three types of lighting at times, these three sources were considered essential to present true color values to customers. Circuit arrangements permit either fluorescent or incandescent lighting to be used separately and, if desired, customers can view carpets with only natural daylight or, by visiting the showrooms in the evening, under artificial sources. By duplicating the type of light which will be prevalent in the purchasers' home, satisfaction for the customer is guaranteed.

The installation was by the Sampson Electric Company in accordance with the plan designed by architect-engineer Stiles Clements.

LIGHTING INSTALLATION calls for 4 watts per sq. ft.; combines fluorescent and incandescent lamps; provides 25 footcandles of intensity in the showrooms of the Zandt Carpet Company, Hollywood, California.

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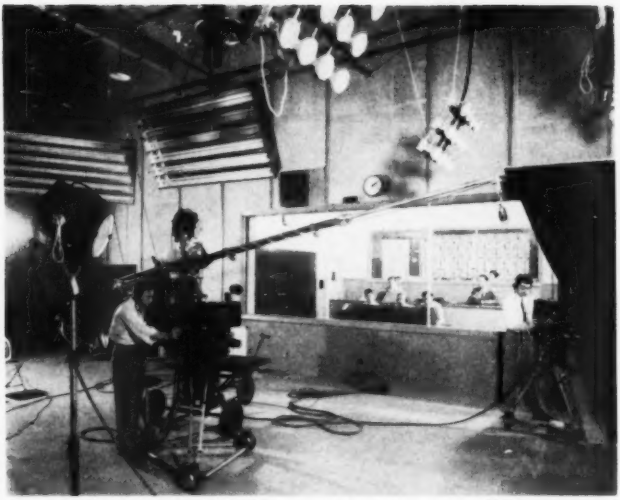

LIGHTING UNITS, broadcasting equipment and glass-enclosed viewing rooms are the "audience" before which performers "strut their hour upon the stage" of the Miami Valley Broadcasting Corporation's studio at WHIO-TV.

Television Studio Has Flexibility

Owners of television sets, watching a broadcast, rarely appreciate that the view of the studio, seen by the performers, is just as interesting as the view appearing on receiver screens. For, behind and above the television cameras, an abundance of lighting units and electrical gadgets are positioned to make the filming of a screen possible. Even in the smaller studios, such as the Miami Valley Broadcasting Corporation's WHIO-TV studio at Dayton, Ohio, equipment is varied and layouts are flexible.

From a position in front of the cameras, performers see banks of overhead R40 floodlamps and series of cold cathode tubes. Large portable spots are on standards for mobile positioning, and an incandescent installation with RLM reflectors furnishes general illumination for rehearsing.

Most of the lighting equipment can be readily shifted, and an overhead pipe grid makes it possible to suspend equipment in accordance with shifting action areas and lighting requirements.

Also seen by performers are air conditioning vents and ducts, intercom speakers and, of course, the cameras, microphone booms, clocks and "on the air" signs. Studios can be draped for private auditions or, with drapes pulled back, they can be viewed through glass walls from the clients' lounge, control booth and/or announcer's studio. Lighting in these locations is recessed fluorescent, lens controlled.

Louvered Light for Barber Shop

Intensities of 120 footcandles illuminate the chairs in the Beverly-Wilshire Hotel Barber Shop, Beverly Hills, California, providing excellent lighting for accurate hair cutting, safe shaving or comfortable reading on the part of the customers. The area immediately around the chairs is lighted to levels of 110 footcandles while traffic areas drop to 25 fc. To provide this illumination, seven Ruby Lighting 4-foot square eggcrate-louvered fixtures are recessed into the acoustical tile ceiling. Fixtures are on 6-foot centers (a fixture over each chair) and contain six 40-watt T-12 standard-start Warm-tone fluorescent lamps each.

As originally installed, a plastic sheet was placed on top of the louvers with the assumption that greater diffusion would be more comfortable to customers when they looked directly upwards into the fixture. However, after trial, it was proved that customers rarely look directly up and, when they do while being shaved, they generally close their eyes. Further, barbers definitely desired definition, not diffusion, for individual hairs can be noticed more distinctly under direct lighting. The plastic sheets were therefore removed, resulting in approval on the part of the barbers and the customers.

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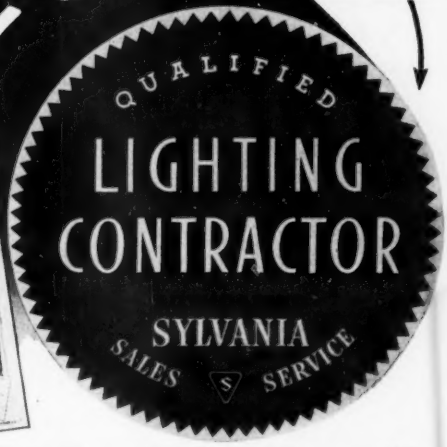

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A full-dress consumer campaign will tie in all dealers who display this Sylvania sign. This emblem will be featured in full-page national ads in magazines such as, Time, Newsweek, Business Week . . . and on the popular national CBS-TV show "Beat the Clock".

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LOUVERED SQUARES, backed by six 40-watt fluorescent lamps, provide 120 footcandles in barber shop of the Beverly-Wilshire Hotel, Beverly Hills, California. Auxiliary incandescent light is provided by lensed and louvered flush-mounted units over work shelves and traffic areas.

In addition to this main lighting plan, two lensed flush-mounted two-lamp 50-watt incandescent units are located over each work shelf, and four flush-mounted single 100-watt incandescent louvered units are mounted over the center section which has a ceiling slightly higher than the average which is 8 feet.

Chairs are upholstered in dark green plastic, floors are of medium green asphalt tile and ceilings are light green. Walls are paneled in dark mahogany.

The George W. Carter Company served as general contractor, with the architectural plan designed by W. L. Pereira. Engineering and electrical installation is credited to John Grady.

Store Uses Domes With Silvered Bowl Lamps

Ceiling domes measuring 42 inches in diameter and spaced on 10-foot centers furnish a pleasing pattern in Milliron's Westchester department store, Los Angeles, California. Lamps are 300 and 500-watt silver bowl units, with truncated collars surrounding them to provide a glare-killing cutoff ring. Directly beneath these Domolites (manufactured by the American Lighting Equipment Company), lighting levels measure 55 footcandles.

Other areas of the same store are illuminated by other incandescent combinations, such as this same dome in a different pattern or R-40s recessed into ceiling patterns. Wall display cases have separate in-built overhead light sources to give added sales punch to goods on these shelves.

LEVELS OF 55 FOOTCANDLES are provided by 300-watt silvered bowl incandescent lamps placed in 42-inch recessed domes spaced at 10 foot intervals in Milliron's Westchester department store, Los Angeles, California.

"Our oven erection superintendents find the Amprobe most useful for testing motor loads and line voltage," reports Mr. Tinker. "We intend to supply every one of our 27 field men with an Amprobe."

"20 AMPROBES ALREADY BEING USED BY OUR FIELD SUPERINTENDENTS" *writes W. G. Tinker,*

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"The Amprobe is an essential piece of our testing equipment for checking transformers and motor currents."—*Milton H. Chase, Mgr., Homestead Utilities, Prudence Island, R. I.*

"It's the answer to a majority of trouble tests."—*A. R. Akins, Maintenance Foreman, G. S. Suppiger Co., 800 So. Morrison Ave., Collinsville, Ill.*

"Would not want to be without it."—*R. H. Heinze, owner, Heinze Refrigeration Company, 114 N. 13th St., Fort Dodge, Iowa.*

AMPROBE—THE SNAP-ON VOLT-AMMETER THAT FITS IN YOUR POCKET!

Reads current without interrupting circuit or breaking insulation

Look what you can do with this one pocket-size tool: Determine load conditions instantly without having to shut down equipment. Spot motor overloads and underloads. Diagnose trouble calls faster, under actual load. Check line voltage and drops. Set overload relays, etc.

- So compact, it fits in your pocket.
- ½ the usual size—only 7".
- ⅓ the usual weight—only 14 oz.
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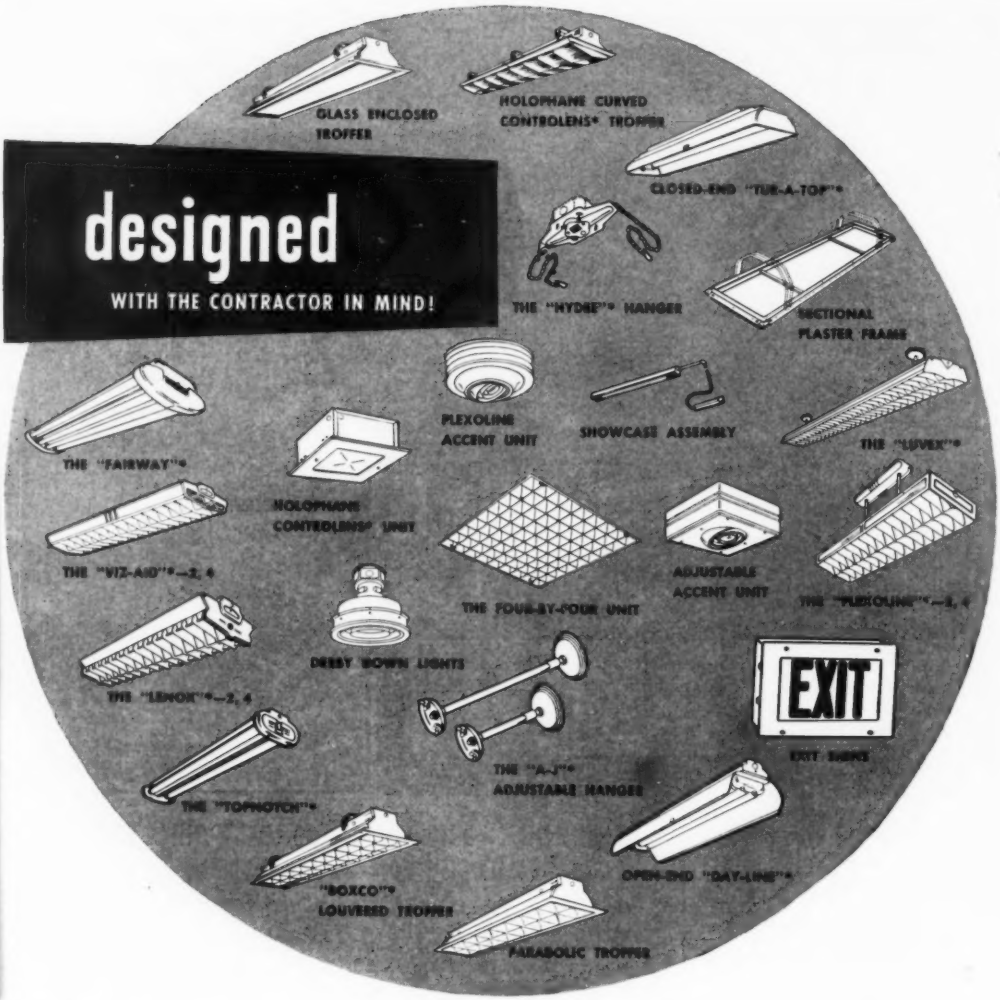

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042

PREMIUM QUALITY WITHOUT PREMIUM COST

In the News

Mobilization Speeds Up

Washington Roundup reveals military spending is at faster pace, increased production to follow.

THE program for mobilization and national defense is now well under way. It is beginning to move at a faster pace. Policy has generally been set, and by mid-year most of the individual programs will be in full operation. This was clearly outlined by Charles E. Wilson, Director of the Office of Defense Mobilization, in his speech in mid-January before the Poor Richard Club in Philadelphia, and substantiated by more recent defense mobilization activities in Washington and elsewhere.

Referring to President Truman's State of the Union message early in January, Mr. Wilson summarized the task ahead as outlined by the President at that time, as follows:

> **"We must expand our forces to 3,500,000 men, or more; we must equip them; we must help equip our Allies in Europe and Asia with the means of defense; we must expand our capacity to produce military items, and build reserves for possible war and also for a civilian economy."**

As Director of ODM, created within the Executive Office of the President, Mr. Wilson is charged with the duty, on behalf of the President, to direct, control and coordinate all mobilization efforts. These include production, procurement, manpower, food, transport activities, maintenance of a sound economy, and foreign aid. To discharge these functions, Wilson has set up by January 1st an all-embracive defense mobilization organization. ODM itself does not perform any operating functions. But it does determine overall policies, and coordinate the activities and programs of the mobilization effort, and keeps the machinery of defense mobiilization running smoothly. These operating functions are being carried out by the newly created Defense Production Administration, Economic Stabilization Agency, and the various Federal departments and agencies brought under the direction of ODM to form the defense mobiilization organization.

These agencies know the task ahead, and the part each is to take in the program. For weeks they have been whipping into shape their individual programs, and taking such action as is deemed necessary and in the interest of the mobilization effort. One tough problem for these agencies still exists, but is gradually being solved. This problem is the staffing of the agencies with qualified personnel.

In discussing the problem of mobilization in his Philadelphia speech Wilson said:

> **"To my mind our principal progress (in mobilization) to date has been that we have definitely clarified our problem to ourselves, and have made the general policy for its solution. The next step, as we set some of the remedies and programs in motion, lies in conveying to our fellow-citizens an understanding of what there is to do and what we are doing."**

Aside from Wilson's own capable leadership, there is one major factor which has done much to firm up policy and remove the taint of confusion. The military now know what kind of a fighting force they want, what they will need for it, and how long it will take to get it. Result—military contracts are now pouring out.

With goals for military strength and industrial readiness firmed up, DPA and other defense mobilization agencies have been able to establish their own individual goals and outline their own plans. Here is the overall problem as expressed by Wilson:

> **"Our mobilization task is two-fold in nature; first, to produce quickly the weapons necessary for us and our allies. Second, as a long-run job, that we expand our capacity to produce munitions and also to produce basic materials for all kinds of goods—military and peacetime. Of course, there will be dislocations."**

The gradual speedup of military spending and commitments, now scheduled to total $87-billion by mid-1952, is already increasing the impact on metals. Direct military needs now take about 7 percent of steel, and is expected to double by year's end. Essential supporting industries, such as freight cars, industrial expansion, etc., will probably exceed direct military requirements. The use of copper in military goods is expected to exceed 40 percent of the total available supply in this year's fourth quarter. And military needs for aluminum will be in excess of 35 percent of the total this year. Cobalt, tin, chrome, nickel, zinc and some other metals have been critically short for some time, and defense requirements for these metals will take most of the available supply.

Controls and regulations now in force were designed primarily to slow down civilian production, spending, building construction, etc., and to insure the availability of materials and metals needed in the limited defense production program post-Korea. The single-band defense order (DO) rating, for example, has been used primarily to insure delivery of defense materiel on a time schedule—not as a priority for one production program over another. Impact of military and essential civilian production on metals and materials is gradually making present controls inadequate, as was expected by NPA officials when military spending was stepped up to a more rapid pace. Result: a new controlled materials plan (CMP), closely resembling World War II CMP, is now being worked up and is scheduled to be put in effect by DPA on July 1st.

The new CMP will be based on complete government regulation of the use of steel, copper and aluminum. There will be allocation programs to secure these and other scarce materials for military equipment and such essential civilian activities as electric, gas and other utilities; shipping and other forms of transportation; building of new defense plants, hospitals, and schools.

Building construction, which provides much of the market for the electrical construction industry, is now being estimated at some $23-billion for 1951. But this construction will be switched from the 1950 pattern. Home building will be cut by some 40 to 50 percent, and 1951 homes will be primarily for defense workers in defense production areas. Commercial construction will suffer severe cutbacks, and will be done only on authorization

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of NPA regional field offices of the Commerce Department. Fourteen such field offices will be in operation by Feburary 15th.

Taking up the slack in building resulting from present construction bans will be military building and federal construction, plus industrial plant expansion and modernization. Defense requirements from now to mid-1953 may put some $8-billion to $9-billion of military-naval public works under contract during that period. While the Navy will handle much of the military construction, the Army Engineers will be the really big construction buyer.

Copper Problem

Current and pressing immediate problems in the electrical industry generally relate to shortages of copper. Limitations imposed by the copper order (NPA Order M-12) are affecting not only civilian work in progress, but essential maintenance and repair, and even DO-rated work.

For example, manufacturers of electric motors and industrial controls are having difficluty in obtaining supplies of copper and aluminum. They are unable to get prompt filling of DO orders for these metals, even though the bulk of their business is now in defense and defense-related orders.

Another example is in the motor repair shop industry. In this industry, copper magnet wire is used to rewind the motors, and the old wire which is taken out of the motors is reclaimed and turned back as copper scrap. Repair shops across the country find it increasingly difficult to obtain delivery on copper magnet wire requirements, especially glass insulated wire. These motors are being repaired for industrial plants engaged in highly essential defense production, in mining, and in food and dairy plants.

Manufacturers of low voltage electrical distribution equipment, such as safety switches, branch and service circuit breakers, service entrance equipment, panels, switchboards, knife switches, small air circuit breakers, and busways are limited in production by the provisions of the copper controls Order M-12, and are hampered in production of this equipment for defense plant expansion by long and delayed deliveries of copper.

The NPA has already appointed Industry Advisory Committees to represent most of the groups within the electrical industry facing these and other materials problems. Through meetings of these IAC's with NPA, these problems are being presented and discussed in detail. Adoption of a Controlled Materials Plan on July 1 this year will gradually eliminate most of these problems.

Copper Weights for M-12 Compliance

Compliance with M-12 copper order requires limitation of copper wire use to 85 percent of base period average in February, 80 percent in March. Base period is January 1 to June 30, 1950. The following table prepared by Simplex Wire and Cable Company gives net copper pounds per 1000 feet for electrical wires and cables.

29.26 Use of copper forms and products. Subject to the exemptions stated in 29.28, or unless specifically directed by the National Production Authority, no person shall manufacture, or use in installation or consrtuction:

(b) During the following months a total quantity by weight of the forms and products of copper defined in paragraphs (a), (b), (c), and (d) of 29.23 in excess of the percentages specified with respect to each month of his average monthly use of such material during the base period:

January, 1951 85%, February, 1951 85%, March, 1951 80%.

29.27 Maintenance, repair and operating supplies. Unless specifically directed by the National Production Authority, during the calendar quarter commencing on January 1, 1951, and each calendar quarter thereafter, no person shall use for maintenance, repair and operating supplies a quantity by weight of the forms and products of copper defined in paragraphs (a), (b), (c), (d) and (e) of 29.23 in excess of 100 percent of his average quarterly use for such purposes during the base period.

Pounds of Copper per 1000 Feet

SOLID AND CLASS B STRANDING

ANHYDREX, ANHYDROPRENE, CAMBRIC, BUILDING WIRE, ETC.

Size A. W. G. or M. C. M.	Strds.	Number of Conductors				
		1	Twin	2	3	4
19	Sol.	4.14	8.28	8.45	12.8	17.1
18	Sol.	5.09	10.2	10.4	15.7	21.0
16	Sol.	8.03	16.1	16.4	24.8	33.1
16	7	8.66	17.3	17.7	26.8	35.7
14	Sol.	13.2	26.4	26.9	40.8	54.4
14	7	13.8	27.6	28.2	42.6	56.9
12	Sol.	20.5	41	41.8	63.3	84.5
12	7	21.9	43.8	44.7	67.7	90.2
10	Sol.	32.1	64.2	65.5	99.2	132
10	7	34.1	68.2	69.6	105	140
9	Sol.	40.1	80.2	81.8	124	165
9	7	41.8	83.6	85.3	129	172
8	Sol.	50.1	100	102	155	206
8	7	51.2	102	104	158	211
6	Sol.	79.5	159	162	246	328
6	7	82	164	167	253	338
4	7	130	260	265	402	536
3	7	163	326	333	504	672
2	7	206	412	420	637	849
1	19	262	524	534	810	1079
1/0	19	330	660	673	1020	1360
2/0	19	416	832	849	1285	1714
3/0	19	526	1052	1073	1625	2167
4/0	19	659	1318	1344	2036	2715
250	37	780	1560	1591	2411	3213
300	37	938	1876	1914	2898	3865
350	37	1099	2198	2242	3396	4528
400	37	1249	2498	2548	3859	5146
450	37	1412	2824	2860	4363	5817
500	37	1561	3122	3184	4823	6431
550	61	1722	3444	3513	5321	7095
600	61	1870	3740	3815	5779	7704
650	61	2036	4072	4153	6292	8388
700	61	2190	4380	4468	6767	9023
750	61	2333	4666	4759	7209	9612
800	61	2491	4982	5082	7697	10263
850	61	2646	5292	5398	8176	10901
900	61	2801	5602	5714	8655	11540
950	61	2975	5950	6069	9193	12257
1000	61	3118	6236	6361	9635	12846
1250	91	3894	7788	7944	12032	16043
1500	91	4656	9312	9498	14387	19183
1750	127	5442	10884	11102	16816	22421
2000	127	6202	12404	12652	19164	25552

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Maintenance Show Held In Cleveland

Over twelve thousand maintenance men, engineers and plant executives, coming from all sections of the United States, Canada, and many foreign countries, converged on Cleveland January 15-18, 1951, to attend the largest and most elaborate maintenance show and series of intensive meetings on plant maintenance problems ever held. This was the second Plant Maintenance Show and Conference held in the huge Cleveland Public Auditorium. Conferences were held concurrently with the Show, and were jointly sponsored by the American Society of Mechanical Engineers and the Society for the Advancement of Management. Other groups also taking part in the Conferences included the American Society of Lubrication Engineers and Cleveland Engineering Society. L. C. Morrow, consulting editor of *Factory Management and Maintenance*, was general chairman.

On display at the Show was equipment and materials for air conditioning, heating, ventilating, building materials and services, maintenance tools and supplies, electrical equipment, employee relations, training and safety, instruments, meters, gauges, lubricants and lubricating equipment, management consultants and services, materials handling, mechanical rubber goods, paints, painting equipment, product finishes, power generation and distribution, power transmission, and many others. Displays were sponsored by 175 exhibitors, and many visitors described these as highly practical, educational, and instructive, and of better calibre than is usually found at such shows.

The Conference sessions were devoted to 21 different phases of plant maintenance problems, and were participated in by 45 different speakers drawn from a cross-section of American industry.

Conferences were divided into four general sessions, and eight sectional sessions. General sessions were open to all visitors (admitted by registration only), while sectional sessions, with four sessions being run concurrently, were selective by visitors. Attendance at general sessions ranged upwards to 1800 per session, and at sectional sessions ranged upwards to about 800 on the more popular subjects.

The opening general session was devoted to "Preventive Maintenance," and was chairmanned by L. C. Morrow, general Conference Chairman. Individual topics in this session were: "Inspection Procedures and Frequen-

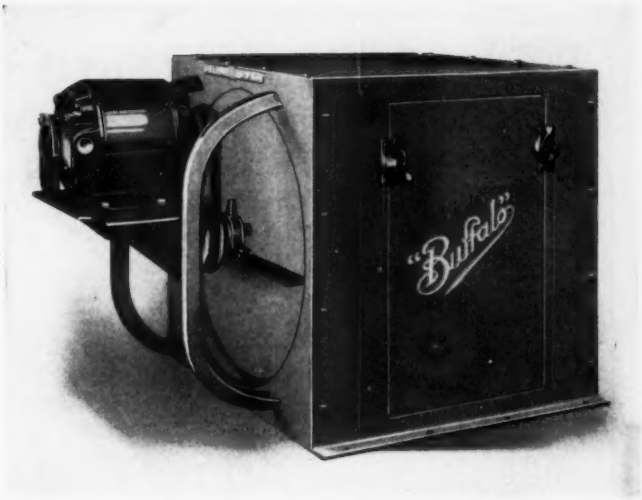
cies," "Records and Reports," and "Training People for Maintenance Work."

Covering the subject of "Inspection Procedures and Frequencies," B. M. Werly and J. E. Gramlich, Eastman Kodak Co., Rochester, N. Y. stated, "Intelligent preventive maintenance . . . reduces production loss from unnecessary shutdowns as well as reduces the cost of repairs by catching them when they are minor rather than waiting until they become major." Regarding electrical maintenance of approximately 2000 dc and 8000 ac motors rated more than ¼-hp. in the Eastman plant, they reported, "Inspection is made weekly on some motors and with greater frequency on others. Some of our conditioning pump motors are checked three times a day. As a result in 1949, out of 10,000 motors in use, we had only 91 motor failures that required rewinding."

Topic for the second general session was "Organization and Management for Maintenance," which was chairmanned by Reber C. Stupp, The Oliver Corp., Cleveland. Individual topics covered in this session were: "Mainteance Costs, Their Control and Budgeting," by H. E. Shaw, Westinghouse Electric Corp., East Pittsburgh, Pa.; "Incentive Payment of Maintenance Workers," by George E. Meyers, Ernst & Ernst, Boston, Mass.; and "Planning and Scheduling Maintenance Operations," by D. G. Jamieson, Canadian Synthetic Rubber Limited, Sarnia, Ont., Canada.

The third general session was conducted by a panel of members of the American Society of Lubrication Engineers, which was devoted to the topic of "Applied Lubrication in Industry." Panel chairman was C. L. Pope, Eastman Kodak Co., Rochester, N. Y. Also taking part in this session were: D. F. Hollingsworth, E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.; Le Roy Miller, Scott Paper Co., Chester, Pa.; Don P. Morrell, Ford Motor Co., Dearborn, Mich.; L. B. Sargent, Jr., Aluminum Company of America, New Kensington, Pa.; Wm. M. Schuck, Armco Steel Corp., Middletown, O.; and Ted R. Witt, Tennessee Eastman Corp., Kingsport, Tenn.

Fourth and last general session was devoted to "Housekeeping," and was chairmanned by W. H. Peter, Jr., Electric Controller & Mfg. Co., Cleveland, Ohio. Individual topics in this session were: "Painting and Decorating," by A. D. Buschman, Perfection Stove Co., Cleveland, Ohio; "Selection and Upkeep of Floors," by Eugene F. Mumaw, Ford Motor Co., Dearborn, Mich.; and "Maintaining Proper Standards of



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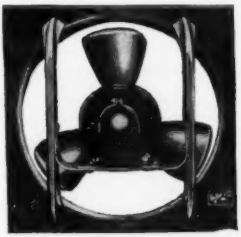

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Two of the sectional conference sessions were of especial interest to electrical maintenance people. First was "Maintenance of Electrical Equipment," chairmanned by Sidney W. Watkins, Warner & Swasey Co.

Covering this subject from an in-plant organization standpoint, Mr. Watkins observed "Maintenance of electrical equipment is classified by the efficiency experts as a non-productive function or service in modern industrial management which relegates it to secondary consideration." Further, he charged that "Management has failed to recognize the vital contribution that electrical energy and electrical equipment is making in the operation of modern industry," and concluded, "A revaluation of the function of electrical maintenance . . . offers the logical solution to the existing conditions."

Assisting Mr. Watkins were: K. C. Mobarry, General Electric Co., Cleveland; and Ralph E. Valentine, Ocean Accident and Guarantee Corp., Ltd., New York, N. Y.

Topic of the second sectional conference of interest to electrical people was "Selection and Maintenance of Lighting Equipment," chairmanned by Berlon C. Cooper, *Electrical Construction and Maintenance*, New York. Assistant chairmen were: H. F. Keene, Western Electric Co., Inc., N. Y., N. Y., and George S. Ketter, B. F. Godrich Co., Akron, Ohio.

"Maintenance of lighting systems is necessary to keep 'light loss' at a minimum," Mr. Cooper observed, "since it is 'light loss' plus the hidden economic advantages of good lighting with which lighting maintenance men are primarily concerned."

"The major objective in the selection of industrial lighting equipment is the proper quantity and quality of illumination for the seeing tasks encountered in industry," Mr. Keene pointed out.

George S. Ketter covered the phase of "maintenance" of lighting equipment, giving the basic fundamentals involved, and case histories from the Goodrich plants. "Maintenance should be based upon a regular and systematic schedule and should include a system of reports and checks."

Other subjects covered in sectional sessions were: "Maintenance of Power Plant and Heating Equipment," "Maintenance Problems of the Small Plant," "Maintenance in Chemical Plants," "Maintenance in Paper and Paper Products Plants," "Maintenance in Food Processing Plants," and "Maintenance in Metal-Working Plants."

Rogers Heads Chicago NISA Group

Baird Rogers, Rockford Power Machinery Division of Mid-States Industrial Corp., Rockford, Ill., was recently elected president of the Electric Motor & Service Association Chicago. J. G. Lessel, Central Motor & Repair Co., Chicago, is the new vice president. Re-elected as secretary and treasurer respectively were H. W. Reeve, Inland Industrial Electric Service Co.; and E. K. Nettgen, Arthur Wagner Company of Chicago.

New members of the Board include: A. J. Ebling, Ebling Electric Co.; A. Marcus, Ther Electric and Machine Works both of Chicago; and Fred H. Westphal, Westphal & Company, Janesville, Wisconsin. Serving unexpired terms are Charles Becker, G. F. Glave and E. S. Michaletz.

Dates Ahead

National Adequate Wiring Bureau—7th annual conference, Sheraton-Gibson Hotel, Cincinnati, Ohio, February 15-16.
North Central Electrical Industries—All-Industry Convention, Hotel Nicollet, Minneapolis, Minn., February 25-28.
Illuminating Engineering Society—Southwestern Section, Driscoll Hotel, Corpus, Christi, Texas, March 4-6.
National Electrical Manufacturers Association—Edgewater Beach Hotel, Chicago, Ill., March 12-15.
RLM Standards Institute—Special Meeting, Edgewater Beach Hotel, Chicago, Ill., March 14.
Electrical Maintenance Engineers Association of Southern California—Fifth Annual Industrial Electrical Show, Shrine Convention Hall, Los Angeles, California, March 15-17.
Edison Electric Institute—17th Annual Sales Conference, Edgewater Beach Hotel, Chicago, Ill., April 2-5.
Chicago Electrical Industry Trade Show—Sponsored by Electric Association of Chicago, Sherman Hotel, Chicago, Ill., April 2-5.
Midwest Power Conference—Hotel Sherman, Chicago, Ill., April 4-6.
Illuminating Engineering Society—Southern Section, Atlantic Hotel, Miami Beach, Fla., April 9-10.
National Industrial Service Association—Annual Convention, San Antonio, Texas, April 15-18.
Chamber of Commerce—39th Annual Meeting, Washington, D. C., April 30-May 2.
National Materials Handling Exposition—International Amphitheatre, Chicago, Ill., April 30-May 4.
National Fire Protection Association—Annual Meeting, Detroit, Michigan, May 7-11.
Illuminating Engineering Society—Canadian Section, Hotel Frontenac, Quebec City, Quebec, May 9-12.
National Association of Electrical Distributors—Atlantic City, N. J., Week of May 20th.
Illuminating Engineering Society—Great Lakes Section, Hotel Gibson, Cincinnati, Ohio, May 24-25.
Edison Electric Institute—Denver, Colo., June 4-7.
Canadian Electrical Manufacturers Association—General Brock Hotel, Niagara Falls, Ont., September 26-28.
Illuminating Engineering Society—National Technical Conference, Hotel Shoreham, Washington, D. C., August 26-September 1.
National Farm Electrification Conference—Hotel Gibson, Cincinnati, Ohio, October 9-10.
National Electrical Contractors Association—Annual Convention, Shoreham Hotel, Washington, D. C., October 9-12.
National Electrical Manufacturers Association—Chalfonte-Haddon Hall, Atlantic City, N. J., November 12-15.

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EMMAUS PENNSYLVANIA

HELP YOURSELF TO LOWER TAXES

[FROM PAGE 59]

An electrical contractor in New England lost his building through fire. It was insured for $100,000. The insurance was held up through a technicality. Meanwhile, the contractor had the opportunity to purchase another building for $100,000. Rebuilding would have cost about $100,000, so the contractor felt he might as well buy the new building immediately without waiting for the insurance to be paid.

Before going ahead, however, he investigated the tax effects. His caution saved him thousands of dollars. This was the reason:

The building had been depreciated until, at the time of the fire, its value on the books was $50,000. The $100,000 insurance proceeds, therefore, represented a book gain of $50,000.

If the contractor had purchased the new building *before* receiving the insurance, *he would have had to pay taxes on the full $50,000 book profit.*

These taxes would have been payable even though the insurance merely paid for the replacement, and no actual gain resulted.

To avoid a taxable gain, you must purchase your replacement *after*—never before—you receive the insurance.

It is usually a good idea to put the insurance money in a separate bank account, so you can definitely trace all the proceeds of the awards into payments for the new property purchased.

Repairs and Improvements

An electrical contractor named Woods decided to make some alterations in his shop.

He asked a contractor to estimate on the following work: repairing bad spots in the roof; replacing the coal furnace with an oil burner; relocating the steam pipes; mending broken plaster; painting walls and ceilings; and remodeling the offices. The estimate was $10,000, which Woods believed he could deduct from his taxable income.

Before signing the contract, however, he checked up on the facts. It was well he did. If he had gone ahead as planned, he would have lost a deduction of $4,000.

This is how he would have lost it:

From a tax standpoint, repairs are considered steps necessary to keep property in reasonable condition without adding appreciably to its value. In this case, the Treasury would consider as repairs: fixing the bad spots

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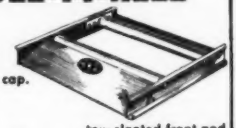

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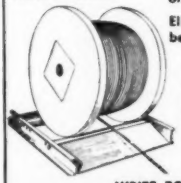

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on the roof, relocating the steam pipes, mending the broken plaster, and painting the walls and ceilings. All the other items would probably be considered improvements.

The repairs amounted to $4,000, the improvements $6,000. Woods had separate contracts drawn up to cover the improvements and the repairs. By doing this, he was able to deduct the $4,000 repair bill from his income taxes.

If the repairs had been made along with the improvements, or a separate itemized list of them had not been kept, the repairs would have been classed as improvements and no deduction would have been allowed.

You can eventually recover the cost of improvements through depreciation. But you cannot deduct the full cost in the year in which they are made, as you can for repairs.

Depreciation

When you buy assets (machines, buildings, etc.) which do not wear out within a year, you are allowed to deduct a portion of the cost from your income over what is considered the useful life of the asset. The allocation of cost over the estimated life is known as depreciation.

Depreciation is complicated. For instance, the first step in figuring depreciation is to determine the cost of the item. But is the cost of the item what you paid for it? Not necessarily. It may be cost, installation, freight, improvements and carrying charges.

The government publishes depreciation rates on new machinery, but not on second-hand machinery. Your regular accountant can help you set a rate of depreciation on second-hand equipment which will be acceptable to the Treasury and fair to you.

To secure maximum credit for depreciation, it is absolutely essential to have complete records. On large items, it is best to keep separate records for each asset.

Inventory

Proper computation of inventory can save you important tax money year in and year out. The Treasury permits you several alternatives in computing inventory. You should be sure you are computing inventory on the basis most profitable to your type of operation. Inventory accounting is so complex that an attempt to illustrate a principle here might be misleading.

Records

Tax economy is directly dependent upon records. Without records, you risk higher taxes. The Treasury has

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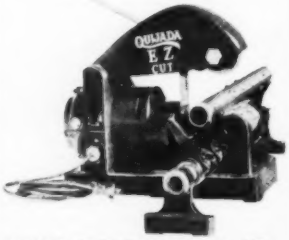

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court precedent to "bear down heavily on those whose inexactitude (failure to prove exact costs) is of their own making."

A good accounting system—installed by a certified public accountant—will help you keep not only your taxes, but other costs, under closer supervision. Your accountant will show you how to make entries so that, unless your volume is large, you may not need a full-time bookkeeper.

High Tax Years

In a period when taxes are high, obviously you should try to reduce your taxable income.

You may be able to do this by spending money to insure the continuity of your business. For example, spend money on advertising, breaking in new help, installing a new accounting system.

Settle bad debts in a high tax year. If only part of the debt is bad, settle the bad part. Return equipment you no longer need but on which you are still paying. If you can, take *now* any loss that you are certain to have in the near future.

Importance of Tax Economy

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DETROIT'S RECIPROCAL LICENSING PROGRAM

[FROM PAGE 63]

ing same. Journeyman electrician cards (license) bear the number of the licensing community.

All licenses and registration cards are good for one year and carry a renewal option. Failure to renew within two months after expiration may lead to another examination.

Advantages of the Plan

Because the industry and cooperating municipalities wanted to experiment with and thoroughly test their program, very little has been said about it in the past. In the interim, the "bugs" have been eliminated and the mechanics of operation streamlined. Today there is no question but what it is a workable plan highly endorsed by all phases of Detroit's electrical industry.

The plan has definitely standardized licensing procedure and requirements; placed license procurement strictly on a qualification basis; eliminated the multiple-fee problem; developed an effective means of policing the industry through its Central File system. Other advantages, difficult to attain in the past, have accrued during operation of the program.

Electrical codes in the cooperating municipalities now contain uniform requirements, a feature which simplifies design and job engineering for the electrical contractor.

Because of uniform code regulations, electrical equipment requirements throughout the area encompassed by the program are now uniform. A natural result is a reduction in the number of types of equipment needed in contractor and wholesaler warehouses.

The program is a cooperative electrical industry project, sponsored, financed and administered by individuals whose prime interest lies in the efficient and safe installation of electrical equipment and systems. Political influence and pressure are conspicuous by their absence.

Reciprocal licensing has worked so well in the electrical field that other service groups in the Detroit area have been studying it carefully during the past few years. At present, a newly organized Reciprocal Heating Council is developing a similar program for the heating contractors. Also interested are the air conditioning, refrigeration, elevator, sign erector, structural welder, and wrecking contractors.

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HOW TO PHASE OUT SWITCHGEAR CONNECTION

(FROM PAGE 55)

7. Connect generator cables to generator terminals T1, T2, and T3 in the same positions they were before being disconnected in Step 1.

8. *Start the generator and bring it up* to approximate rated voltage and speed.

9. *Watch the phase indicator to see* if the phase sequence when the phase sequence indicator is energized from the generator is the same as the sequence when energized from the bus (Step 4). If the sequence is the same in both cases, the generator is properly connected to the switchgear and ready to be synchronized in on the bus. If the sequence differs from that in Step 4, the generator is incorrectly connected and the procedure of Steps 10 and 11 must be carried out.

10. *If the phase sequence in Step 9 is reversed* relative to that observed in Step 4, shut down the generator and interchange the generator cables connected to any two of the generator terminals T1, T2, and T3. Then repeat Steps 8 and 9 to confirm phase sequence correction.

11. *Interchange the secondary wiring* of two of the neutral current transformers in the phases corresponding to the generator cables which were interchanged in Step 10. For example, if the main cables on generator Terminals T1 and T2 were switched, the secondary wires on current transformers associated with generator terminals T4 and T5 must be interchanged.

12. *After completing Steps 1 through 9* (and Steps 10 and 11 if the original connections were incorrect), disconnect the phase sequence indicator. Rack the generator circuit breaker into normal position and synchronize it in on the bus according to standard operating procedure.

The same step-by-step procedure may be used to phase out 220, 440, or 550-volt equipment if potential transformers are included in the switchgear. If no potential transformers are included, the phase sequence indicator may be used as shown in Figure 8.

Checking Sequence at Circuit Breaker

When using the method shown in Fig. 8, connect the phase sequence indicator first to the bus terminals of the circuit breaker as indicated by the solid lines. This determines phase

sequence on the bus. Then shift the indicator leads to corresponding generator terminals of the circuit breaker as indicated by the dotted lines. Bring the generator up to approximate rated voltage and speed to determine whether or not the phase sequence of the generator and bus match at the circuit breaker terminals. If not, Steps 10 and 11 of the foregoing procedure must be carried out.

To check the synchroscope and synchronizing wiring in low voltage installations, disconnect the generator cables from either the switchgear or generator terminals. Then close the circuit breaker and synchronizing switch and note whether or not the scope pointer rests at the "12 o'clock" or "zero degrees" mark on the dial. When the cables are disconnected from the generator terminals, the cables must be braced apart to prevent grounds or short-circuits.

In both cases, carefully mark the cables so that they may be reconnected to the same terminals from which they were removed. After checking the synchroscope for operation and proper wiring connections, open the synchronizing switch, open the circuit breaker and reconnect the cables to the same terminals from which they were disconnected.

After the phase sequence of the generator and the bus match at the corresponding terminals of the generator circuit breaker, the breaker may be synchronized in on the bus in accordance with standard operating practice.

These methods of establishing correct connections between electrical apparatus and switchgear will be found advantageous from the standpoints of accuracy, reliable results, a minimum of test equipment, and minimizing of hazards to personnel and apparatus.

FARM WIRING SPECIALISTS Adrian Johnson (left), Hallock, Minn.; and Bill Saverien, Donaldson, Minn., don't find it too difficult to sell the farmer electrical adequacy.

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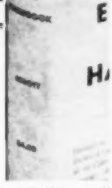

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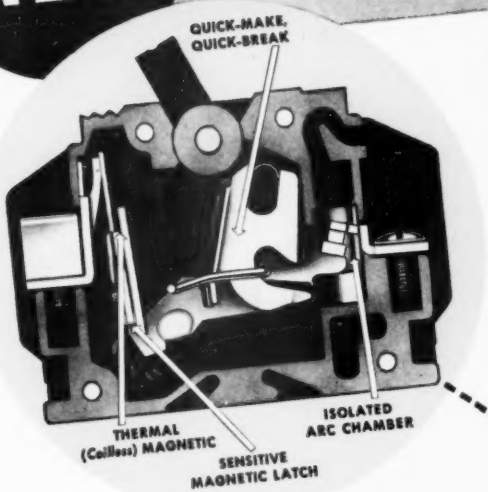
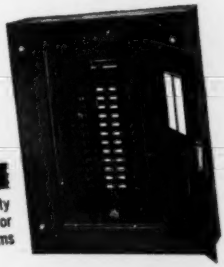
NEW TYPE QB CIRCUIT BREAKER for NQB Lighting Panelboards

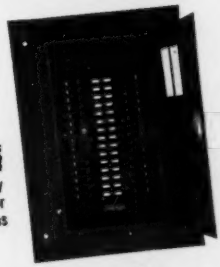


Completes the Line

TYPE **NMO**
MO Plug-In Standard Duty breakers for AC systems



TYPE **NQB**
QB heavy duty breakers for AC systems



TYPE **NAB**
ML heavy duty breakers for AC-DC systems

a NEW QB circuit breaker for NQB panelboards features an isolated arc chamber lined with arc resisting material which eliminates need for metal plates or other interrupting means. Operating mechanism is quick-make, quick-break. Stainless steel latch, independent of trip element, assures superior vibration characteristics. Thermal-(*Coilless*) Magnetic trip element is typical of other lighting panelboard types in Square D's broad line.

All Have 2-WAY PROTECTION

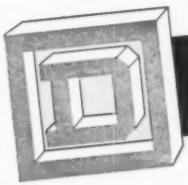
THERMAL element is a bi-metal providing positive and timed response to heating effects of both load current and surrounding atmosphere. The life of wire insulation is prolonged by limiting total temperature to a safe value.

MAGNETIC element responds instantaneously to the higher values of current characteristic of dangerous overloads and "shorts." Damage is minimized.

Both ARE NEEDED FOR Complete PROTECTION

Write for Bulletin 1640, Square D Company, 6060 Rivard Street, Detroit 11, Michigan

ASK YOUR ELECTRICAL WHOLESALER FOR SQUARE D PRODUCTS



SQUARE D COMPANY

DETROIT · MILWAUKEE · LOS ANGELES

SQUARE D COMPANY CANADA LTD., TORONTO • SQUARE D de MEXICO, S.A., MEXICO CITY, D.F.

DO YOU KNOW THESE 5 TIMELY

G-E WIRING FACTS?

1. HOW MUCH EXTRA CURRENT CAN YOU ADD TO EXISTING RACEWAYS?

Size for size, Deltabeston* AVA cables carry more current than ordinary cables—pack more current into raceways—because heat-beating asbestos insulation permits higher operating temperatures. When you specify G-E Deltabeston cables,
HOW MUCH CURRENT CAN YOU ADD?

2. WHAT REALLY MAKES THE DIFFERENCE IN CONDUIT?

Wiring installations get double-protection with General Electric White rigid conduit. First, the top-quality, thoroughly-tested steel pipe is galvanized. Then a tough, smooth coat of Glyptal* lacquer is applied.
BUT WHAT REALLY MAKES THE DIFFERENCE?

ANSWERS

1. ☐ G-E Deltabeston AVA cables can add as much as 64% more current-carrying capacity than ordinary Type R building wire.

2. ☐ G-E White rigid conduit is *hot-dip galvanized* in pure zinc—a premium finish that gives lasting protection.

3. ☐ In laboratory tests General Electric mercury switches stand up under more than a million On and Off cycles—about 247 years of normal use.

4. ☐ The new standard grounding outlet (GE3588) is designed to take three-prong grounding plugs, two-prong polarized plugs, and regular two-prong parallel-blade plugs.

5. ☐ The new line of G-E bar hangers offers you the offset you need. New design lets fixture stud move easily for leveling and positioning, locks it tight when it's set.

3. WHAT IS THE TESTED LIFE OF A G-E MERCURY SWITCH?

The silent General Electric mercury switch has no moving blades or contact springs to wear out—a pool of mercury does all the work! Mercury switches provide exceptionally long service—
CAN YOU GUESS HOW LONG?

4. WHAT'S THE NEW STANDARD GROUNDING OUTLET?

For easy installation the new standard G-E twin grounding outlet can be side wired or back wired, but
WHAT'S THE NEW STANDARD?

5. HOW DO YOU POSITION A BOX EXACTLY WHERE YOU WANT IT?

Positioning a box exactly and bringing it to the exact level is now an easy job with the new G-E bar hangers.
HOW'S IT DONE?

FOR FURTHER INFORMATION on any General Electric wiring materials, see your local G-E Construction Materials Distributor, or write to Section K53-218, Construction Materials Department, General Electric Company, Bridgeport 2, Connecticut.

* *Registered Trade Mark of General Electric Company*

GENERAL ELECTRIC